Dutt · Chatterjee · Geib

# India in Maps

SHOUT
SHARE
IT

# Contents


Preface . . . . . v

Acknowledgments . . . . . vii

1. General . . . . . 2

Physiographic Diagram, 1; An Introduction, 2; Political Administrative System, 4; List of States, Union Territories, and Districts, 4

2. Physical . . . . . 10

Physiography, 1; Physiographic Regions, 11; Geologic Periods, 13; Mean Pressure and Surface Wind, 14; Temperature, 16; Average Annual Rainfall, 16; Precipitation, 18; Soils, 20; Climatic Regions and Natural Vegetation, 22; Land Uses, 26

3. Village-based Primary Economic Activities . . . . . 28

Agricultural Crops, 28; Irrigation, 32; Intensity of Cropping, 34; Green Revolution, 36; Livestock and Poultry, 38; Fisheries, 40

4. Energy and Mineral Resources . . . . . 42

Energy Resources, 42; Mineral Base, 44; Damodar Valley Corporation, 46

5. Industry . . . . . 48

Textiles, 48; Sugar Industry, 50; Chemical Industries, 52; Steel and Other Metal-based Industries, 54; Manufacturing Regions, 58

6. Transport and Foreign Trade . . . . . 60

Railroad System, 60; Road Transport, 62; Airways, Inland Waterways and Ports, 66; Foreign Trade, 68

7. Cultural and Demographic . . . . . 72

Historical Setting, 72; Languages and Linguistic Problems, 76; Religion, 82; Temples, 86; Fusion of Indo-Islamic Art, 94; Housing and House Types, 96; Literacy, 100; Population Density and Growth, 104; Large Urban Centers, 108; Medium- and Small-Size Urban Centers, 108; Calcutta, 112; Bombay, 114; Rural/Urban Change in India, 116

8. Future Perspectives . . . . . 118

Demographic Perspectives, 118; Prospects of the Five-Year Plan, 120

Bibliography . . . . . 122

# Preface

*India in Maps* provides a textual explanation and graphic interpretation of India's political, physical, economic, and social characteristics. With the use of a combination of map and explanation many features are revealed more clearly than with a simple graphic presentation. Photographs and sketches have also been added for the same purpose. Considering the wide range of information in this atlas, only the pertinent aspects are explained with the use of maps. For unity of organization the maps are arranged in seven chapters.

The plans for preparing this book were made in the summer of 1972 at the University of Akron—jointly with Dr. S. P. Chatterjee and Miss M. Margaret Geib. Thereafter, Miss Geib and I were responsible for the overall organization and composition of the book. Miss Geib has designed and compiled the maps. Dr. Chatterjee has contributed the physical geography chapter, whereas the remaining chapters have been written by me.

Some topical maps and some statistics used in this book are based on the sole available materials which may not be complete or thoroughly reliable. Hence, as more additional source materials are obtained, future editions will include the most recent and complete information. Suggestions in this connection are welcome.

Ashok K. Dutt

# Acknowledgments

Dr. Allen G. Noble, Professor of Geography; Dr. Albert Korsok, Associate Professor of Geography; Dr. Laurence Ma, Assistant Professor of Geography; Mr. John Mulhauser, Assistant Professor of Geography; Dr. Frank Costa, Managing Director of the Center for Urban Studies; Mr. Ramesh Dhussa, Graduate Assistant; and Mr. Surinder Aggarwal, Graduate Assistant (all of the University of Akron) all rendered valuable assistance in going through the textual part of the manuscript and making suggestions for additions or improvements. Their help is gratefully acknowledged.

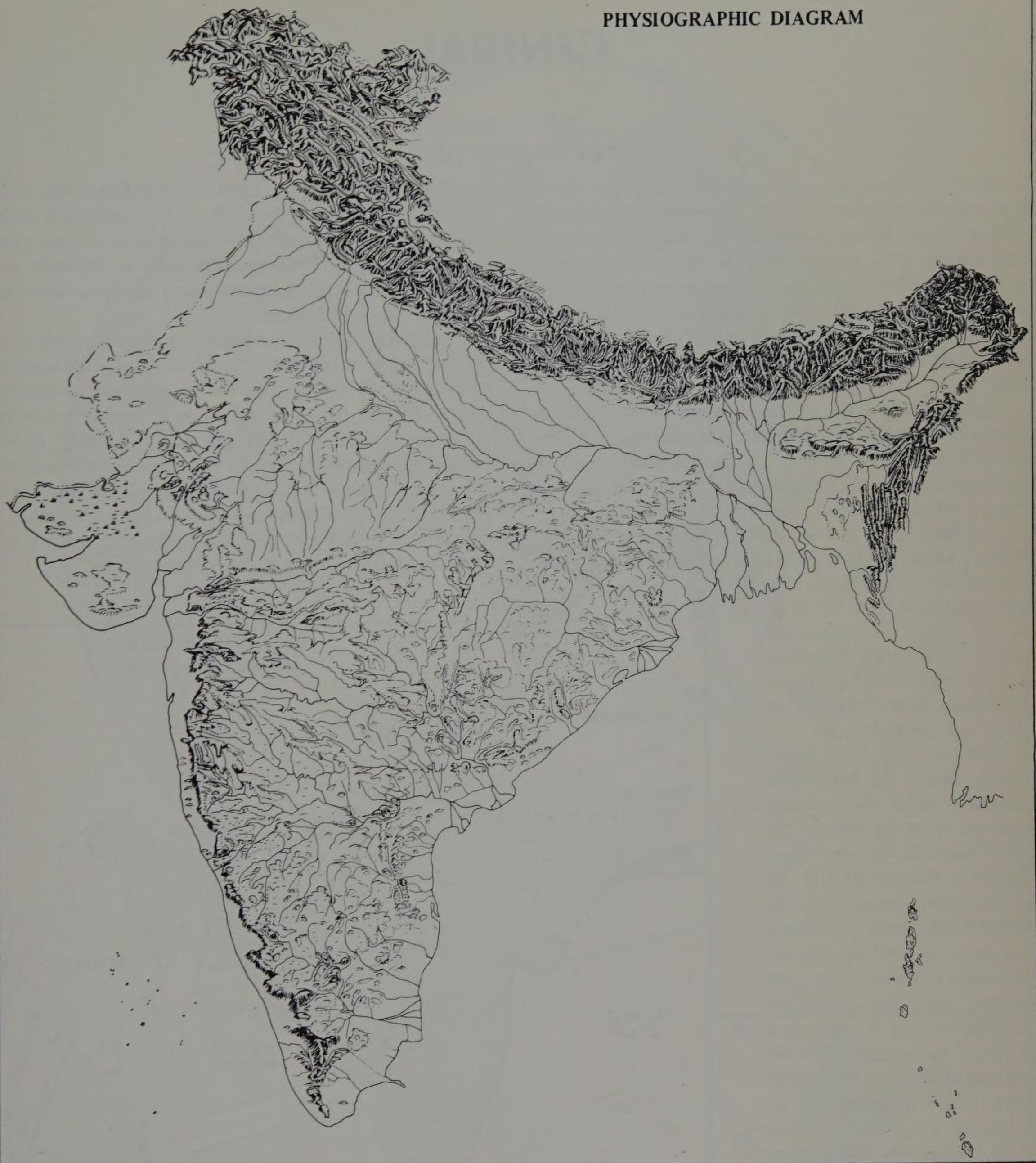
Miss Marnie Sweet, Mrs. Mary Carrol Hansen, Graduate Assistants, Department of Urban Studies, Mr. Satish Devgan, Mr. Stephen Heal and Mr. Bruce Taylor, Graduate Assistants, Department of Geography, University of Akron are thanked for their help in organizing, and proofreading the manuscript.

Mr. Mrinal Dutta, Graduate Assistant, Department of Geography, University of Manitoba and Mr. Dhussa have assisted in researching the maps; Larry Lallo, an assistant with the Geography Department, University of Akron, has prepared some of the initial drafts of the graphs.

Assistance given in typing and retyping the manuscript by Arlene Lane, secretary of Urban Studies; Mr. Satish Devgan, Mr. Stephen Heal and Mr. Bruce Taylor, Graduate Assistants, Department of Geography, University of Akron are thanked for their help in Vukich, Nareene Wong, and Beth Fazio are gratefully acknowledged.

Miss Rinku Dutt and Miss Jhumku Dutt are thanked for drawing all of the sketches and for all of their contributing assistance.

# PHYSIOGRAPHIC DIAGRAM



# Chapter 1

# GENERAL

## AN INTRODUCTION

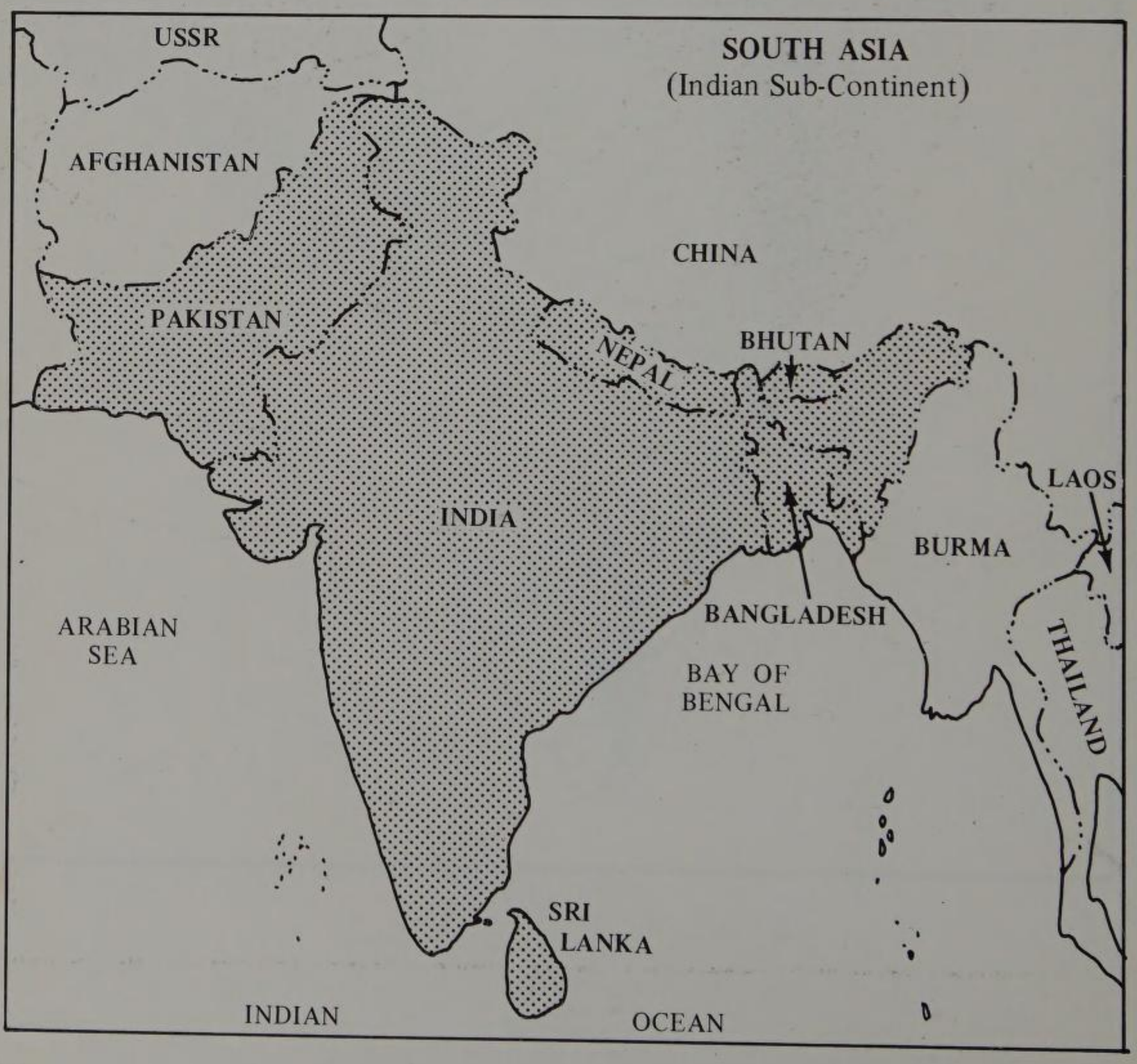
India, a country of ancient civilization, has supported a large population, generation after generation. According to 1975 estimates, India's population has exceeded 600 million, making it the second largest in the world, exceeded only by China. No other country approaches even half the population of India. Though, in terms of area, it is large, 1.28 million square miles (3.28 million square km), six other countries including the United States are larger than India.

Lying entirely in the northern hemisphere, its mainland extends between 68°7′E and 97°25′E longitudes and 8°4′N and 39°6′N latitudes. Some of its island territories, such as Andaman-Nicobar and Lakshadweep lie in the Bay of Bengal and the Arabian Sea. India's 9,500 mile long (15,200 km) land frontier borders Bangladesh, Burma, Bhutan, Nepal, and Afghanistan, and also nations like Pakistan and the Peoples Republic of China, with whom India has fought wars since her independence. India's coastline of 3,801 miles (6,083 km) faces the Indian Ocean, the Bay of Bengal and the Arabian Sea.

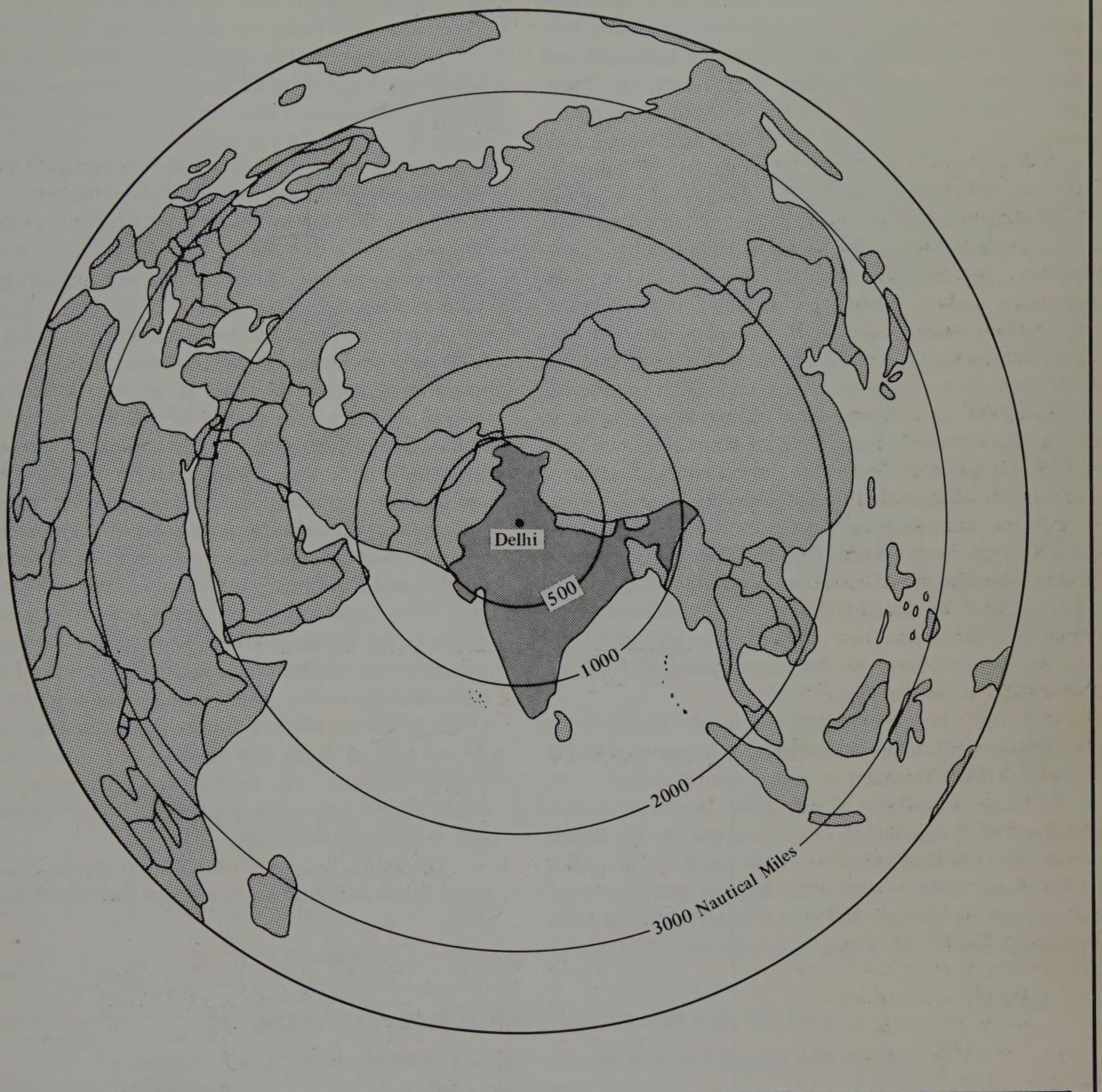
India is the most viable country within the Indian subcontinent, which is physically separated from the rest of the Asian landmass by the Great Himalayan Ranges. Most of the subcontinent constituted the former British India, which was partitioned in 1947 creating two independent states: India and Pakistan. Since then, India has remained unified in its general territorial jurisdiction, whereas Pakistan has been further subdivided by the breaking away of its eastern wing, East Pakistan, which became the independent nation of Bangladesh Republic in 1971.

Being at the northern flank of the Indian Ocean, India is strategically located in terms of controlling this ocean both for military purposes and operation of oceanic trade routes. As India is the largest democracy in the world, successes and failures of this country have significant repercussions for the world at large.

India is a poor, but developing country. In the historical past it was considered to be one of the most prosperous countries of the world, but one of the main reasons for current poverty lies in its lack of deep involvement in the industrial revolution during the British Colonial Period (1757-1947). However, India's endeavors for development based on modernization after its independence places it in the ranks of "developing countries." Daniel Moynihan, a former U.S. Ambassador to India, rightly said, "India is not an underdeveloped country, but a poor country."



## WORLD LOCATION



## POLITICAL ADMINISTRATIVE SYSTEM

The Indian political system is unique in many respects. The Indian government, following independence, adopted certain socialistic policies: target-oriented national plan, nationalization of banks and coal mines, state ownership of the railroad and major bus transportation operations, new steel mills, many machine making factories, armament and other military equipment-making installations, etc. Nonetheless, private enterprise coexists with these socialistic government policies. Almost all of the agricultural land, most of the urban property, large numbers of industrial operations, and most of the retail and wholesale businesses, are privately owned.

In the midst of poverty and scarcity, India has undertaken the difficult task of developing and maintaining a democratic system of government based on free voting rights for individuals over the age of twenty-one. Developing countries in Asia and elsewhere, including most of India's immediate neighbors, after being freed from colonial rule, generally turned to military or dictatorial forms of government. However, until 1976 India had clung to a kind of federally-based parliamentary democracy, with national elections taking place at least once every five years.

The current political system in India is based on a constitution adopted on January 26, 1950, the bases of which lie in democracy, secularism, and equality. Women have equal rights; "untouchables," who were traditionally considered as a lowly caste, are equal to other men under the law. The official name of the nation, designated by the constitution, is the Republic of India.

India has a federal system of government similar to the United States but its central government has more power in comparison. The President of India, who is elected in an indirect way by members of the central legislature (parliament) and state legislatures, is a figurehead like the British Crown. The principal executive power resides in the office of the Prime Minister who is the majority party leader of the national parliament. The first Prime Minister of India was Pandit Jawaharlal Nehru, who held the office for 17 years. He was also one of the leaders of the nonaligned, third-world group of countries. As of 1976, his daughter, Mrs. Indira Gandhi, holds the office of the Prime Minister, having held it since 1966. The headquarters of the central government is in Delhi, the capital of India.

Until recently, the country was divided into 21 states which have elected legislatures and, in many administrative matters, autonomy. Nine union territories, directly governed by the central (or union) government though their local legislatures have some limited powers. Sikkim, a protectorate inherited from British times, was incorporated into India in April of 1975. . . . Sikkim, thus, is India's 22nd state.

The states and the union territories are divided into districts which in 1971 totaled 355. A district is governed by a group of appointed civil servants headed by a District Magistrate responsible to the respective state and union territory governments. In terms of administrative hierarchy, the districts are comparable to counties in the United States. One of the primary differences between the district and the county organizations lies in the fact that the Indian district administrators are not elected, whereas the U.S. county officials are. A strongly-knit bureaucratic apparatus exists in India from the federal level down to state, district, and still lower levels of administration. At the village, town, and city levels, local self-government exists which in the villages is known as *Panchayat*; in towns and comparatively smaller cities, as *Municipality*; and in larger cities, as *Corporation*. These local governments are elected by the people for terms of four to five years. However, they do not have as much responsibility or power as American civic governments. The local governments in India, for example, are not responsible for the police, high school education, or judiciary functions.

The states, union territories, and districts have been listed below and their locations have been identified on the map.

### LIST OF STATES, UNION TERRITORIES, AND DISTRICTS

(States have been indicated in all capitals, Union Territories in italics, and districts in upper/lower case)

**States and Districts**

I. JAMMU AND KASHMIR

1. Anantnag
2. Baramula
3. Doda
4. Jammu
5. Kathua
6. Ladakh
7. Punch
8. Rajauri
9. Srinagar
10. Udhampur

II. PUNJAB

11. Amritsar
12. Bhatinda
13. Firozpur
14. Gurdaspur
15. Hoshiarpur
16. Jullundur
17. Kapurthala
18. Ludhiana
19. Patiala

GENERAL ADMINISTRATIVE DIVISIONS
BIHAR State and Union Territory Name
National Capital
State and Union Territory Capital
International Boundary
State and Union Territory Boundary
AFGHANISTAN
Kabul
Islamabad
Srinagar
JAMMU AND KASHMIR
HIMACHAL PRADESH
Simla
PUNJAB
Chandigarh
HARYANA
Delhi
UTTAR PRADESH
Jaipur
RAJASTHAN
Lucknow
Patna
BIHAR
Kathmandu
NEPAL
SIKKIM
Gangtok
Thimphu
BHUTAN
ARUNACHAL PRADESH
Ziro
ASSAM
Gauhati
Shillong
MEGHALAYA
NAGALAND
Kohima
Imphal
MANIPUR
TRIPURA
Agartala
BANGLADESH
Dacca
Aijal
MIZORAM
BURMA
Rangoon
WEST BENGAL
Calcutta
MOUTHS OF THE GANGES
Bhopal
MADHYA PRADESH
Gandhinagar
GUJARAT
Bhubaneswar
ORISSA
Bombay
DAMAN
DIU
Silvassa
DADRA AND NAGAR HAVELI
MAHARASHTRA
Hyderabad
ANDHRA PRADESH
Panaji
GOA
KARNATAKA
Bangalore
Madras
PONDICHERRY (P)
TAMILNADU
KERALA
Trivandrum
Cape Comorin
GULF OF MANAAR
SRI LANKA
Port Blair
ANDAMAN AND NICOBAR ISLANDS
LAKSHADWEEP MINICOY AND AMANDIVI ISLANDS
Kavaratti
(P)
ARABIAN SEA
BAY OF BENGAL
CHINA
PAKISTAN
INDUS RIVER
GANGES
YAMUNA RIVER
NARMADA RIVER
MAHANADI RIVER
GODAVARI RIVER
KRISHNA RIVER
BRAHMAPUTRA RIVER
GULF OF KHAMBHAT
0 300 MILES
0 300 600 KILOMETERS
68° 72° 76° 80° 84° 88° 92° 96°
36° 32° 28° 24° 20° 16° 12° 8°

20. Ropar
21. Sangrur

III. HARYANA

22. Ambala
23. Gurgaon
24. Hisar
25. Jind
26. Karnal
27. Mahendragarh
28. Rohtak

IV. HIMACHAL PRADESH

29. Bilaspur
30. Chamba
31. Kangra
32. Kinnaur
33. Kulu
34. Lahul and Spiti
35. Mahasu
36. Mandi
37. Simla
38. Sirmaur

V. UTTAR PRADESH

39. Agra
40. Aligarh
41. Allahabad
42. Almora
43. Azamgarh
44. Bahraich
45. Ballia
46. Banda
47. Bara Banki
48. Bareilly
49. Basti
50. Bijnor
51. Budaun
52. Bulandshahr
53. Chamoli
54. Dehra Dun
55. Deoria
56. Etah
57. Etawah
58. Faizabad
59. Farrukhabad
60. Fatehpur
61. Garhwal
62. Ghazipur
63. Gonda
64. Gorakhpur
65. Hamirpur
66. Hardoi
67. Jalaun
68. Jaunpur
69. Jhansi ~
70. Kanpur
71. Kheri
72. Lucknow
73. Mainpuri
74. Mathura
75. Meerut
76. Mirzapur
77. Moradabad
78. Muzaffarnagar
79. Naini Tal
80. Pilibhit
81. Pithoragarh
82. Pratapgarh
83. Rae Bareli
84. Rampur
85. Saharanpur
86. Shahjahanpur
87. Sitapur
88. Sultanpur
89. Tehri Garhwal
90. Unnao
91. Uttarkashi
92. Varanasi

VI. BIHAR

93. Bhagalpur
94. Champaran
95. Darbhanga
96. Dhanbad
97. Gaya
98. Hazaribagh
99. Monghyr
100. Muzaffarpur
101. Palamau
102. Patna
103. Purnea
104. Ranchi
105. Saharsa
106. Santhal Parganas
107. Saran
108. Shahabad
109. Singhbhum

VII. WEST BENGAL

110. Bankura
111. Birbhum
112. Burdwan
113. Calcutta
114. Cooch Behar
115. Darjeeling
116. Hooghly
117. Howrah
118. Jalpaiguri
119. Malda
120. Midnapore
121. Murshidabad
122. Nadia
123. Purulia
124. 24 Parganas
125. West Dinajpur

VIII. ASSAM

126. Cachar
127. Darrang
128. Goalpara
129. Kamrup
130. Lakhimpur
131. Mikir Hills
132. North Cachar Hills
133. Nowgong
134. Sibsagar

IX. MEGHALAYA

135. Khasi and Jaintia Hills
136. Garo Hills

X. NAGALAND

137. Kohima
138. Mokokchung
139. Tuensang

XI. MANIPUR

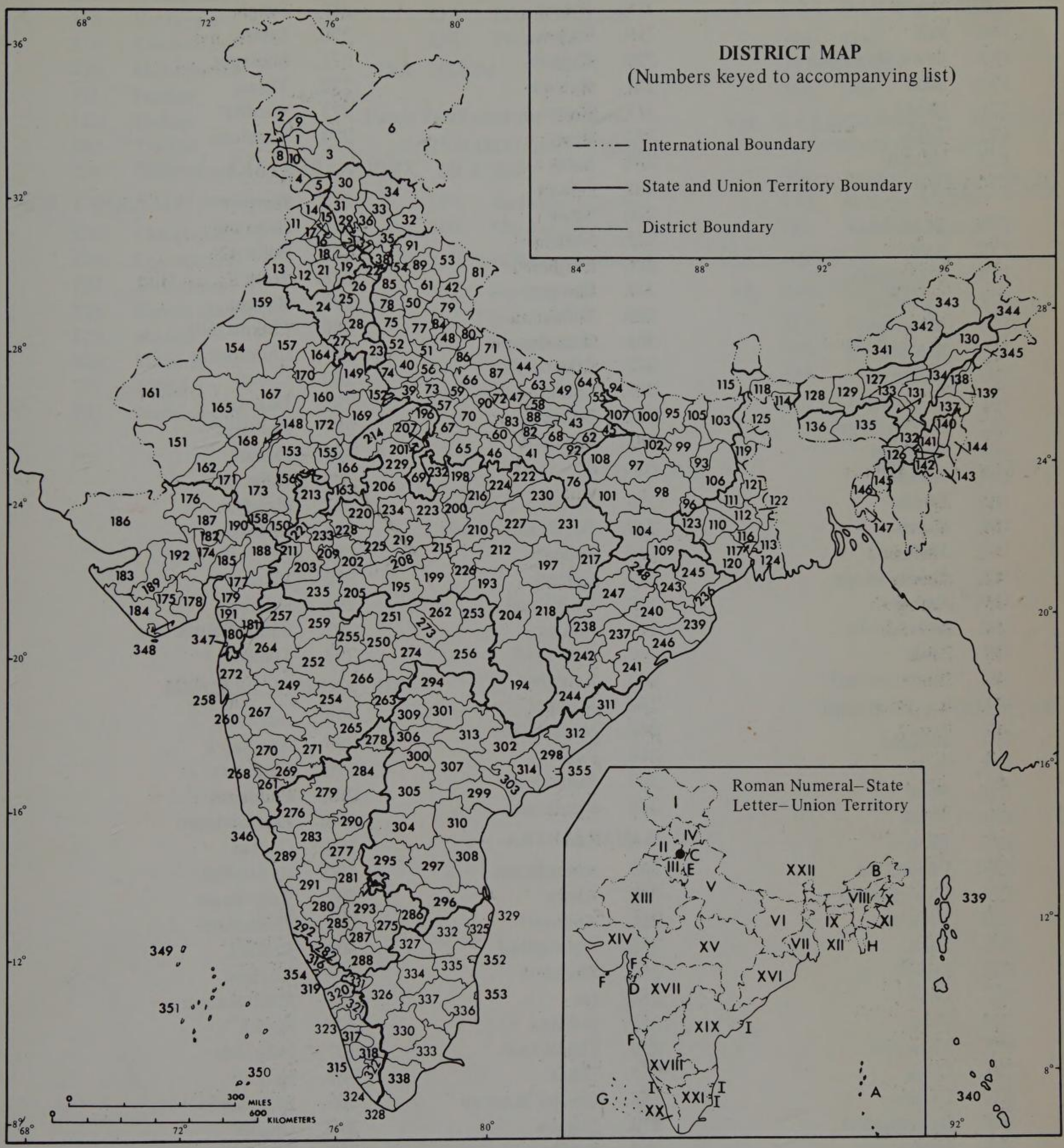
140. Manipur North
141. Manipur West
142. Manipur South
143. Manipur Central
144. Manipur East

XII. TRIPURA

145. North Tripura
146. West Tripura
147. South Tripura

XIII. RAJASTHAN

148. Ajmer
149. Alwar
150. Banswara
151. Barmer
152. Bharatpur
153. Bhilwara
154. Bikaner
155. Bundi
156. Chittaurgarh
157. Churu
158. Dungarpur
159. Ganganagar
160. Jaipur
161. Jaisalmer
162. Jalor


DISTRICT MAP
(Numbers keyed to accompanying list)
International Boundary
State and Union Territory Boundary
District Boundary
Roman Numeral–State
Letter–Union Territory
300 MILES
600 KILOMETERS

163. Jhalawar
164. Jhunjhunun
165. Jodhpur
166. Kota
167. Nagaur
168. Pali
169. Sawai Madhopur
170. Sikar
171. Sirohi
172. Tonk
173. Udaipur

XIV. GUJARAT

174. Ahmadabad
175. Amreli
176. Banaskantha
177. Vadodara
178. Bhavnagar
179. Bharuch
180. Valsad
181. The Dangs
182. Gandhi Nagar
183. Jamnagar
184. Junagadh
185. Kheda
186. Kutch
187. Mahesana
188. Panch Mahals
189. Rajkot
190. Sabarkantha
191. Surat
192. Surendranagar

XV. MADHYA PRADESH

193. Balaghat
194. Bastar
195. Betul
196. Bhind
197. Bilaspur
198. Chhatarpur
199. Chhindwara
200. Damoh
201. Datia
202. Dewas
203. Dhar
204. Durg
205. Khandwa
206. Guna
207. Gwalior
208. Hoshangabad
209. Indore
210. Jabalpur
211. Jhabua
212. Mandla
213. Mandasor
214. Morena
215. Narsimhapur
216. Panna
217. Raigarh
218. Raipur
219. Raisen
220. Rajgarh
221. Ratlam
222. Rewa
223. Sagar
224. Satna
225. Sehore
226. Seoni
227. Shahdol
228. Shajapur
229. Shivpuri
230. Sidhi
231. Surguja
232. Tikamgarh
233. Ujjain
234. Vidisha
235. Khargon

XVI. ORISSA

236. Balasore
237. Baudh Khondmals
238. Balangir
239. Cuttack
240. Dhenkanal
241. Ganjam
242. Kalahandi
243. Keonjhar
244. Koraput
245. Mayurbhanj
246. Puri
247. Sambalpur
248. Sundargarh

XVII. MAHARASHTRA

249. Ahmadnagar
250. Akola
251. Amravati
252. Aurangabad
253. Bhandara
254. Bir
255. Buldana
256. Chandrapur
257. Dhule
258. Greater Bombay
259. Jalgaon
260. Kolaba
261. Kolhapur
262. Nagpur
263. Nanded
264. Nasik
265. Osmanabad
266. Parbhani
267. Pune
268. Ratnagiri
269. Sangli
270. Satara
271. Sholapur
272. Thana
273. Wardha
274. Yavatmal

XVIII. KARNATAKA

275. Bangalore
276. Belgaum
277. Bellary
278. Bidar
279. Bijapur
280. Chikmagalur
281. Chitradurga
282. Coorg
283. Dharwar
284. Gulbarga
285. Hassan
286. Kolar
287. Mandya
288. Mysore
289. North Kanara
290. Raichur
291. Shimoga
292. South Kanara
293. Tumkur

XIX. ANDHRA PRADESH

294. Adilabad
295. Anantapur
296. Chittoor
297. Cuddapah
298. East Godavari
299. Guntur
300. Hyderabad
301. Karimnagar
302. Khammam
303. Krishna
304. Kurnool
305. Mahbubnagar
306. Medak
307. Nalgonda
308. Nellore
309. Nizamabad
310. Ongole
311. Srikakulam
312. Visakhapatnam
313. Warangal
314. West Godavari

XX. KERALA
- 315. Alleppey
- 316. Cannanore
- 317. Ernakulam
- 318. Kottayam
- 319. Kozhikode
- 320. Malappuram
- 321. Palghat
- 322. Quilon
- 323. Trichur
- 324. Trivandrum

XXI. TAMILNADU
- 325. Chingleput
- 326. Coimbatore
- 327. Dharmapuri
- 328. Kanniyakumari
- 329. Madras
- 330. Madurai
- 331. Nilgiri
- 332. North Arcot
- 333. Ramanathapuram
- 334. Salem
- 335. South Arcot
- 336. Thanjavur
- 337. Tiruchchirappalli
- 338. Tirunelveli

XXII. SIKKIM

**Union Territories and Districts**

I. *ANDAMAN and NICOBAR ISLANDS*
- 339. Andaman Islands
- 340. Nicobar Islands

II. *ARUNACHAL PRADESH*
- 341. Kameng
- 342. Subansiri
- 343. Siang
- 344. Lohit
- 345. Tirap

III. *CHANDIGARH*

IV. *DADRA and NAGAR HAVELI*

V. *DELHI*

VI. *GOA, DAMAN and DIU*
- 346. Goa
- 347. Daman
- 348. Diu

VII. *LAKSHADWEEP, MINICOY, and AMINDIVI ISLANDS*
- 349. Lakshadweep Islands
- 350. Minicoy Islands
- 351. Amindivi Islands

VIII. *MIZORAM*

IX. *PONDICHERRY*
- 352. Pondicherry
- 353. Karikal
- 354. Mahe
- 355. Yanam

# Chapter 2

# PHYSICAL

## PHYSIOGRAPHY

India is comprised of three major geological units based on the distinct differences between large-scale landforms. The oldest and the most stable landmass of India, the Deccan Plateau, forms the first geological unit. Of the three units it is the southernmost occupying more than three-fourth's of the total area of the country. In the earliest period of its geologic history the Deccan experienced deposition of marine sediments, remnants of which are found in the Aravallis, the Vindhyas, and the Cuddapah basin in south India, and in the Chattisgarh basin in Madhya Pradesh. Subsequently, at the beginning of the Tertiary Era, the Deccan Plateau was covered by huge outpourings of lava from numerous fissures in the earth's crust. In a large part of the Deccan (Madhya Pradesh-Gujarat-Maharashtra), layers of basalt are predominant on the surface.

To the north of this old stable landmass lies the second geological unit, the youngest in geologic age. The oldest part of this unit cannot be more than one million years old. Alluvial stream deposition is the chief characteristic. Thus, this unit comprises the alluvial plains of the Indus, Ganges (or Ganga), and Brahmaputra Rivers, the river plains and deltas of the east coast, and the whole of the present sand-covered surface of Rajasthan.

Bordering India in the north stands the third geological unit, which unlike the other two units remained under seas during its formative years. Later, in the early Tertiary Period, tremendous pressures accounted for a great uplift of sediments to form the highest mountain ranges of the present day—the Himalayas. Bold relief and great elevation characterize this region.

Physiographically, India has been divided into 7 macroregions, 20 mesoregions, and 58 microregions for detailed study. The macro- and mesoregions have been delimited on the inset map, and all regions have been delimited on the main map. A general sketch of the seven macro physiographic regions provides a broad base of knowledge about Indian landforms.

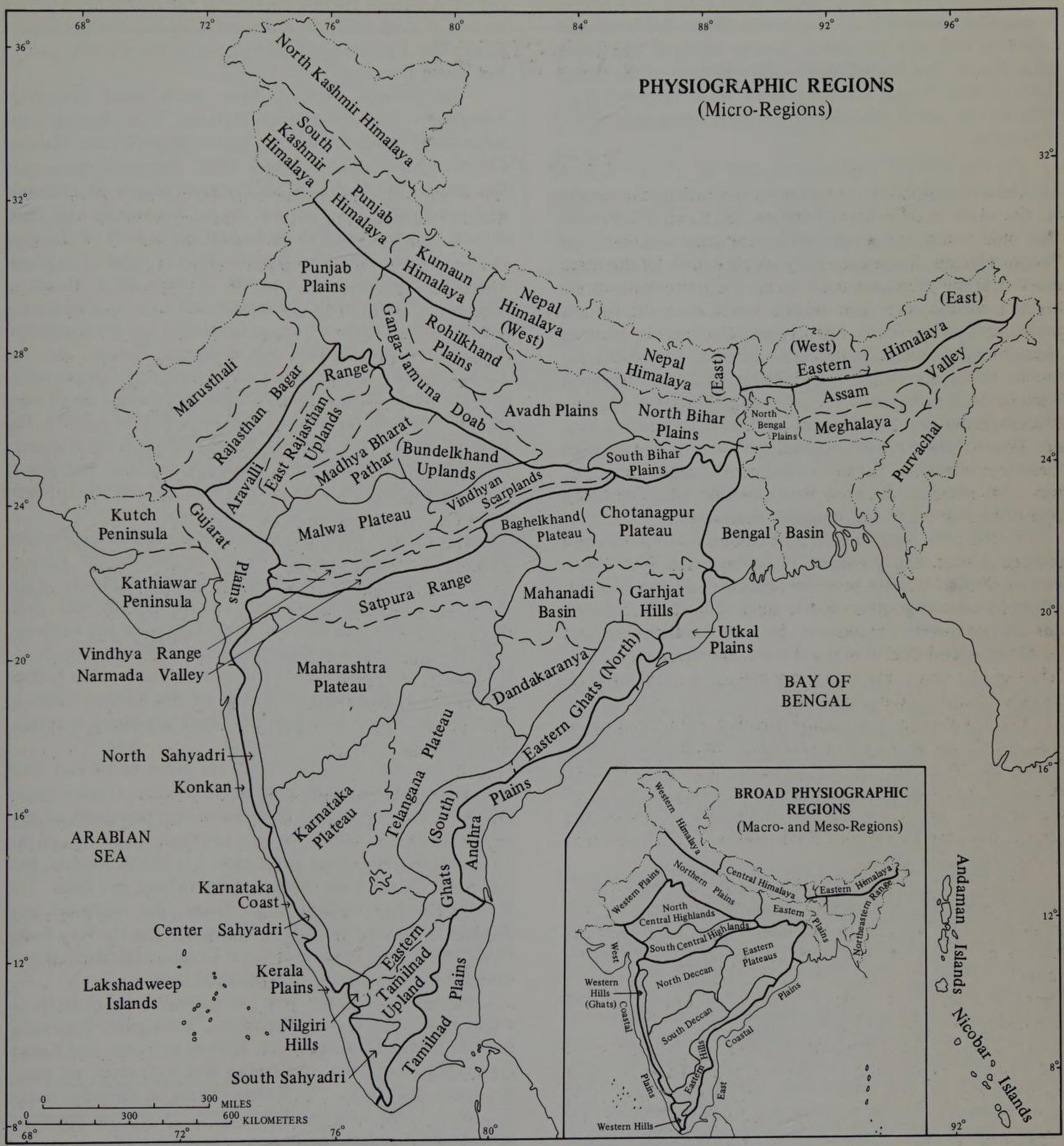
(1) *The Northern Mountains* consist of the Himalayas and other mountain ranges in the northeast. The Himalayas are divided into three mesoregions: the Western Himalaya, Central Himalaya, and Eastern Himalaya. Because of the differences involved the Western Himalaya is further divided into 4 microregions: the North Kashmir Himalaya, South Kashmir Himalaya, Punjab Himalaya, and Kumaun Himalaya. From Nanga Parbat (8,126 m or 26,653′) the snow-clad Great Himalaya extends southeastward for 527 miles (850 km) in Kashmir and divides the North Kashmir Himalaya from South Kashmir Himalaya. In the South Kashmir Himalaya, the Vale of Kashmir is the most suitable area for settlement. The ranges of the Himalaya trending southeastward from Kashmir, enter Himachal Pradesh where they are known as the Punjab Himalaya. Here the headwaters of the Chenab River rise near Bara Lacha La (4,891 m or 16,042′). Two other rivers in Punjab also originate in this part of the Himalayas: the Beas near Rohtang Pass and the Ravi to the west of it. The Sutlej is by far the largest river entering India at the Shipki La (3,505 m or 11,496′) through a deep gorge. Because the river has been dammed just before it leaves the Siwalik Range, a vast lake the Govind Sagar has been formed. The Kumaun Himalaya lies to the east of Punjab Himalaya. The rivers Ganga and Yamuna flow from this highland.

The Central Himalaya lies outside India in Nepal. The Kathmandu Valley divides the Central Himalaya into two parts: Eastern and Western. The majority of eight-thousand meter peaks of the world occur in this part of the Himalayas. Mount Everest (8,848 m or 29,029′) is the world's highest mountain peak, to the west of which lies Manaslu-1, another great peak.

The Eastern Himalaya is divided into two physiographic provinces: its western part lies in Bhutan, Sikkim, and Darjeeling District; the eastern part is in Arunachal Pradesh.

At the eastern end of the great Himalayas, new lower ranges appear, running north-south. This physiographic region, the Northeastern Ranges, includes three major subdivisions: the Purvachal, Meghalaya, and Assam Valley. The Assam Valley is the creation of the Brahmaputra River.

(2) *The Great Plains,* the second major physiographic division, is one of the largest and most densely populated alluvial plains of the world, stretching east-west along the foot of the Himalayas, fanning out at both ends so as to include the humid Bengal Basin in the east and the arid Marusthali in the west. Low relief is the distinct feature of the Great Plains. Physiographically, it is divided into three subdivisions: the Western Plains, Northern Plains, and Eastern Plains. Because of aridity, the Western Plains differ considerably from the other two. It is divided into two provinces: the Marusthali and the Rajasthan Bagar. The Northern Plains subdivision, comprised of *doabs* (land between two rivers) and new alluvial plains is divided into four provinces: Punjab Plains, Ganga-Yamuna Doab, Rohilkhand Plains, and Avadh Plains. The Punjab Plains are remarkably fertile, especially in the Bari Doab between the


PHYSIOGRAPHIC REGIONS
(Micro-Regions)
North Kashmir Himalaya
South Kashmir Himalaya
Punjab Himalaya
Kumaun Himalaya
Nepal Himalaya (West)
Nepal Himalaya (East)
(West) Eastern Himalaya (East)
Valley
Assam
Meghalaya
Purvachal
Punjab Plains
Rohilkhand Plains
Ganga-Jamuna Doab
Avadh Plains
North Bihar Plains
North Bengal Plains
South Bihar Plains
Marusthali
Rajasthan Bagar
Range
Aravalli
East Rajasthan Uplands
Madhya Bharat Pathar
Bundelkhand Uplands
Vindhyan Scarplands
Kutch Peninsula
Gujarat Plains
Kathiawar Peninsula
Malwa Plateau
Baghelkhand Plateau
Chotanagpur Plateau
Bengal Basin
Satpura Range
Mahanadi Basin
Garhjat Hills
Utkal Plains
Vindhya Range
Narmada Valley
Maharashtra Plateau
Dandakaranya
Eastern Ghats (North)
BAY OF BENGAL
North Sahyadri
Konkan
Karnataka Plateau
Telangana Plateau
(South) Ghats
Andhra Plains
ARABIAN SEA
Karnataka Coast
Center Sahyadri
Kerala Plains
Eastern Tamilnad Upland
Tamilnad Plains
Lakshadweep Islands
Nilgiri Hills
South Sahyadri
0 300 MILES
0 300 600 KILOMETERS
BROAD PHYSIOGRAPHIC REGIONS
(Macro- and Meso-Regions)
Western Himalaya
Northern Plains
Central Himalaya
Eastern Himalaya
Northeastern Ranges
Western Plains
North Central Highlands
Eastern Plains
South Central Highlands
Eastern Plateaus
West Coastal Plains
Western Hills (Ghats)
North Deccan
South Deccan
Coastal Plains
Eastern Hills
East Coastal Plains
Western Hills
Andaman Islands
Nicobar Islands

Beas and the Ravi, and the Bist Doab between the Beas and the Sutlej. Of the doabs of India, the Ganga-Yamuna Doab is by far the largest and most densely populated.

The Eastern Plains is further divided into three sections: North Bihar Plains, South Bihar Plains, and Bengal Basin. The monotony of the North Bihar flat landscape contrasts with the somewhat greater relief of the South Bihar Plains. The Bengal Basin embraces most of the Ganga Delta of West Bengal and Bangladesh. As in any other great delta of the world, the Ganga (Ganges) has a web of distributaries.

(3) *The Central Highlands* consist of a wide belt of hilly lands bordered on the west by the Aravalli Range and on the south by the Satpura Range. The Central Highlands with their relief and eroded structures separates the Great Plains from the Peninsular Plateaus. The two subdivisions, North Central Highlands and South Central Highlands are further divided into eight regions based on landform differences. Aravalli Range, East Rajasthan Uplands, Madhya Bharat Pathar (Plateau), and Bundelkhand Uplands belonging to the northern part, and Malwa Plateau, Vindhyan Scarplands, Vindhya Range, and Narmada Valley lying in the southern part. At its northern end the Aravalli Range has almost been reduced to the level of the alluvial plain because of long continued denudation; at the southern end, too, the Range has been considerably dissected. East Rajasthan Upland ranges in height between 820′ (250 m) to 1,968′ (600 m). The Madhya Bharat Pathar is essentially a plateau with a stony and undulating surface. The Malwa Plateau is built of lava with flat topped hills. The Vindhya Range is primarily made up of sandstones and limestones. The Narmada Valley appears to be a structural depression, situated between the Vindhya and the Satpura Ranges.

(4) *The Peninsular Plateaus* constitute the largest physiographic region of India. It is triangular in shape with its apex near Bharuch and base extending from near Cape Comorin to the Rajmahal Hills in Bihar. Two other sides of the triangle run along the Satpura Line and the Sahyadri. The Peninsular Plateau are comprised of five subdivisions: the Western Hills, North Deccan, South Deccan, Eastern Plateaus, and Eastern Hills.

The Western Hills, called the Sahyadri and also known as the Western Ghats, is divided into three parts: Northern, Central, and Southern. The northern part of the Sahyadri is built of horizontal sheets of lava, which, as a result of erosion, have given rise to a typical trap landscape. The Central Sahyadri, between a little south of 16°N latitude to the Nilgiri, is formed of granitoid gneisses which on weathering have given rise to a rugged topography. The southern part of the Sahyadri (Southern Ghats) is separated from the main portion by the Palghat Gap, apparently a rift valley.

The North Deccan is comprised of two sections: the Satpura Range and the Maharashtra Plateau. A high, craggy and sharp-crested ridge, formed of basalt, dominates the western part of the Satpura. The Satpura Range broadens out considerably in the central part, bordered on the north by the Mahadeo Hills and on the south by the Gawilgarh Hills. The eastern part of the Satpura, called the Maikala Plateau, is bordered on the east by the Maikala Range, a great escarpment. Nearly the whole of the Maharashtra Plateau is formed of basalt which upon erosion has resulted in rolling uplands with intervening shallow valleys.

The South Deccan is divided into the Telangana Plateau and the Karnataka Plateau. The Telangana Plateau is carved out of Archaean gneissic rocks, and much of it has a rolling surface dotted with low erosional hills and shallow depressions. The Karnataka Plateau occupies the western part of the South Deccan.

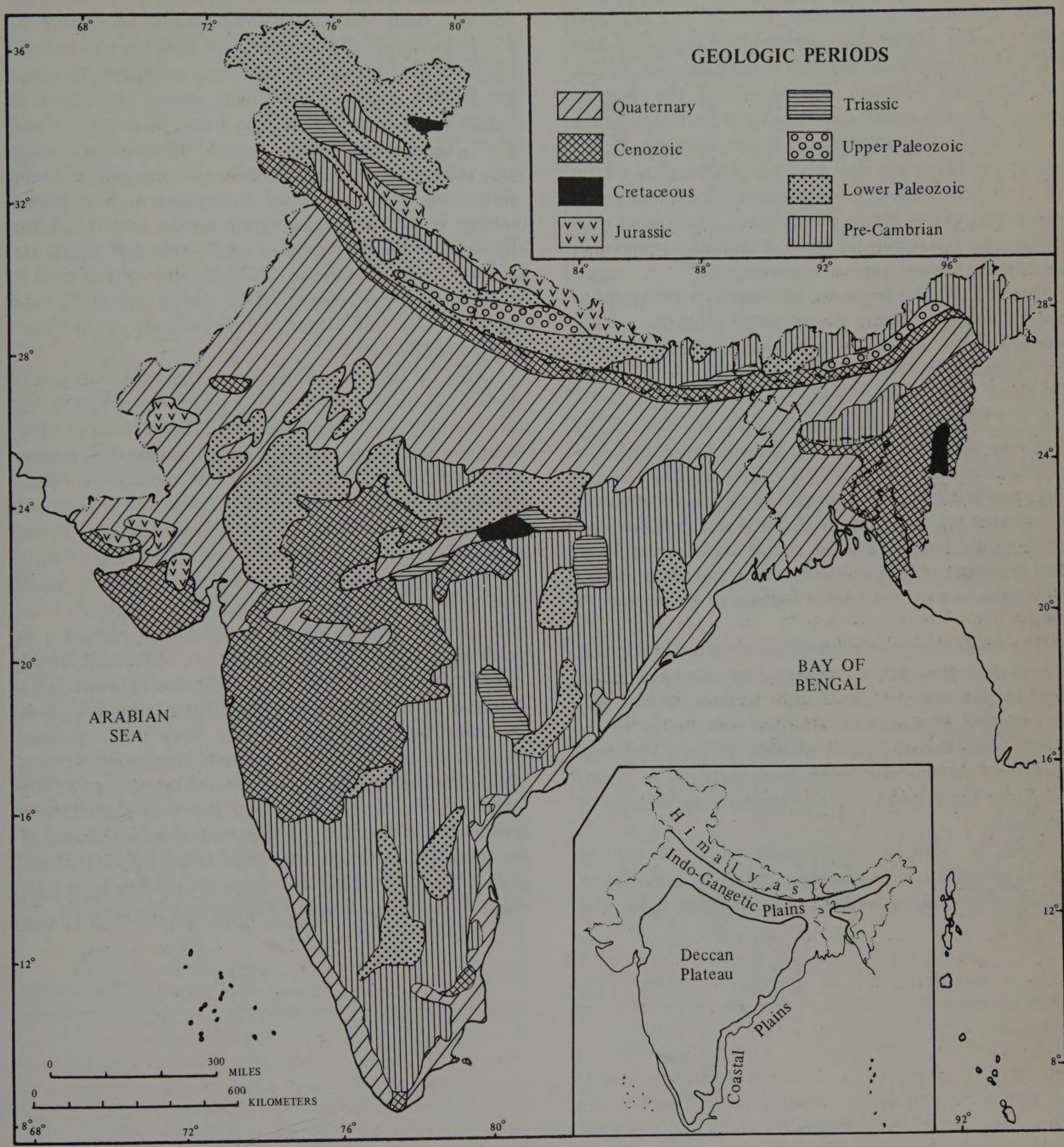
The Eastern Plateaus have much more diversified topography than the Deccan Plateaus. This physiographic subdivision consists of five parts: Baghalkhand Plateau, Chotanagpur Plateau, Garhjat Hills, Mahanadi Basin, and Dandakaranya. Baghalkhand Plateau consists of anticlinal and synclinal valleys carved out of sandstones and limestones, which appear to be ancient mountains of the type of the Aravalli. The Chotanagpur Plateau, where large-scale mineral deposits occur, consists of three large blocks of land at different levels. Its largest and most typical part is the Ranchi Plateau which is developed on granite-gneiss. The Hazaribagh Plateau, the Kodarma Plateau, and the Rajmahal Hills are the other components of this province. The Mahanadi flows through a basin surrounded on all sides by hills rising from 600 to 1,000 m (1,968′ to 3,280′). The floor of the central part of the Mahanadi Basin is mainly composed of horizontally bedded limestones and slates. The Garhjat Hills in Orissa have a wild and densely forested landscape.

The Eastern Hills like their counterpart in the west are essentially a coastal range, better known as the Eastern Ghats, but are disrupted compared to the continuity of the Western Ghats. Nowhere do the Eastern Ghats exhibit their true mountain character so clearly as between the Godavari and Mahanadi Rivers. The Tamilnad Uplands, which include Shevaroy and Javadi Hills, are a fairly wide belt of undulating land lying at the foot of the Eastern Ghats in Tamilnadu. Within this province there are many examples of pediplains.

(5) *The East Coast* lowlands are much wider and drier than their counterparts in the west. The East Coastal Plains and Eastern Continental Shelf form the two parts of this landform region. From north to south the provinces of the East Coastal Plains have been named as Utkal, Andhra, and Tamilnad Plains. Each is marked by at least one delta: The Mahanadi Delta in the Utkal Plains, the Godavari and Krishna Deltas in the Andhra Plains, and the Cauvery Delta in Tamilnad Plains. The Eastern Continental Shelf shows evidence of sea level rise in postglacial times.

(6) *The West Coast* has been divided from north to south into the Kutch Peninsula, Kathiawar Peninsula, Gujarat Plains, Konkan Coast, Karnataka Coast, and Kerala Plains. The coastlines of Konkan and Karnataka are steep and lined with cliffs. The Kerala Plains, on the other hand, are much wider and less hilly. Much variety occurs from place to place within this region.

(7) *Islands* in the Bay of Bengal and the Arabian Sea may be said to make a separate landform division. From the point of view of origin, the Bay Islands (Andaman and Nicobar) differ from the Arabian Sea Islands (Lakshadweep, Amindivi, and Minicoy) in that the former represent elevated portions of submarine mountains, whereas the latter are entirely built of corals.


GEOLOGIC PERIODS
Quaternary
Cenozoic
Cretaceous
Jurassic
Triassic
Upper Paleozoic
Lower Paleozoic
Pre-Cambrian
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 600 KILOMETERS
Himalayas
Indo-Gangetic Plains
Deccan Plateau
Coastal Plains

## MEAN PRESSURE AND SURFACE WIND

Monsoonal circulation of the atmosphere is exemplified by the atmospheric conditions of India. Monsoons are seasonal or periodic winds resulting from differences in heating, and therefore in pressure, between land and water bodies. During winter, with extreme cold developed over Asia, a high pressure cell develops in the northwest. In contrast over the relatively warmer oceans low pressure develops. Air movement consequently is from land to the sea. Dryness is associated with the winter monsoon. During summer the extremely high land temperatures are conducive to the formation of a low pressure cell over the northwestern part of the Indian subcontinent, with higher pressure over the less warm seas. Flow of air then is from sea to land bringing the wet summer monsoon.

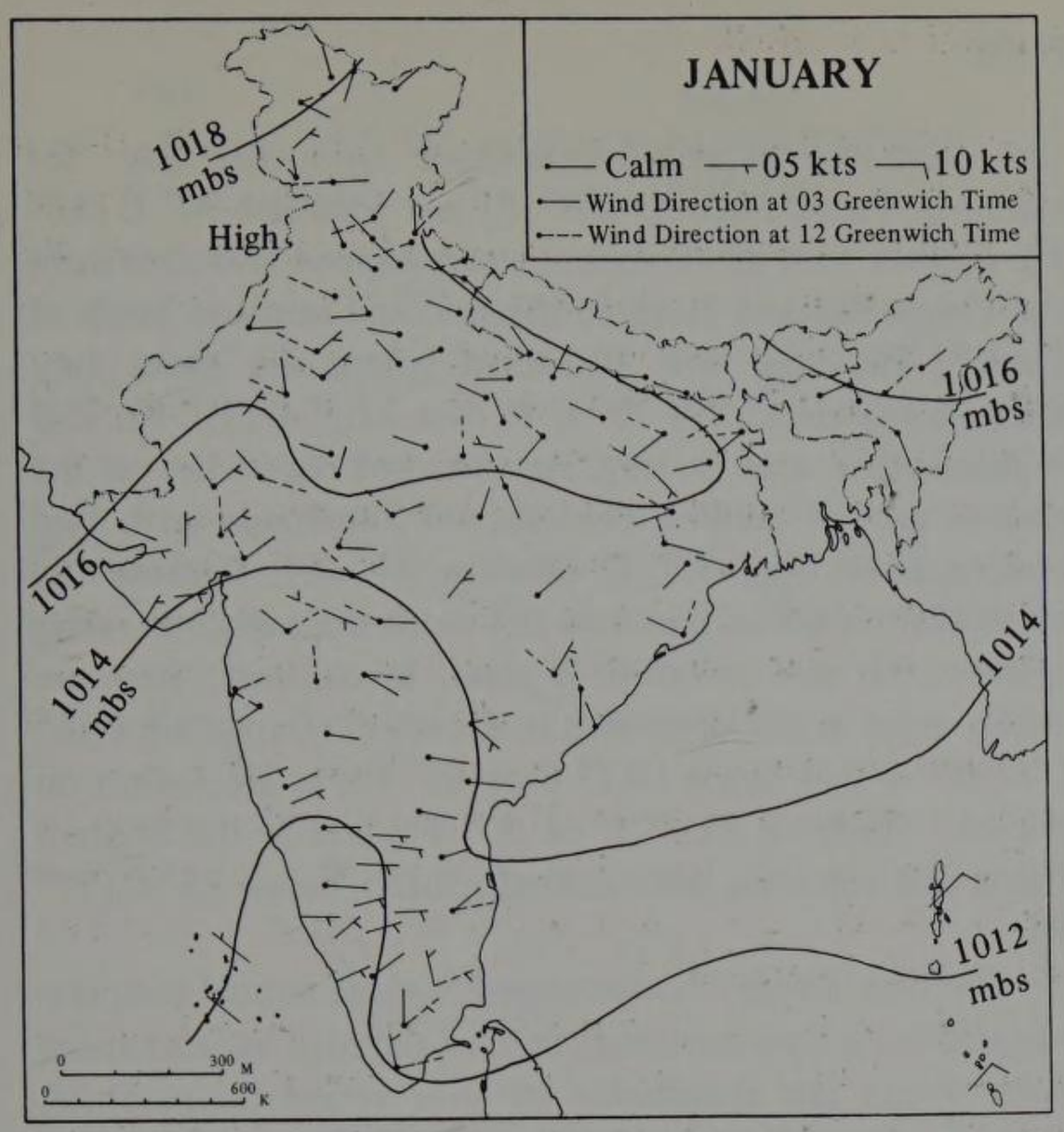
*January.* At the beginning of January, when temperatures in Asia are lowest, the northwest monsoon is fully established over the land and sea areas in India. A belt of high pressure, 1,018 millibars (mbs), prevails over the northwest India above the 32° parallel which decreases southward to 1,012 mbs in the extreme south. The east-running 1,016 mbs isobar closes up in the Eastern Ganges Plains to the east of Patna and runs in a reverse direction leaving India near Jaisalmer. West Bengal and Orissa are subjected to somewhat lower pressure, 1,015 mbs and then the pressure increases again in Bhutan, Assam, and Tripura. Clear skies, fine weather, light northerly winds, and low humidity and temperature are the normal features of the weather in January.

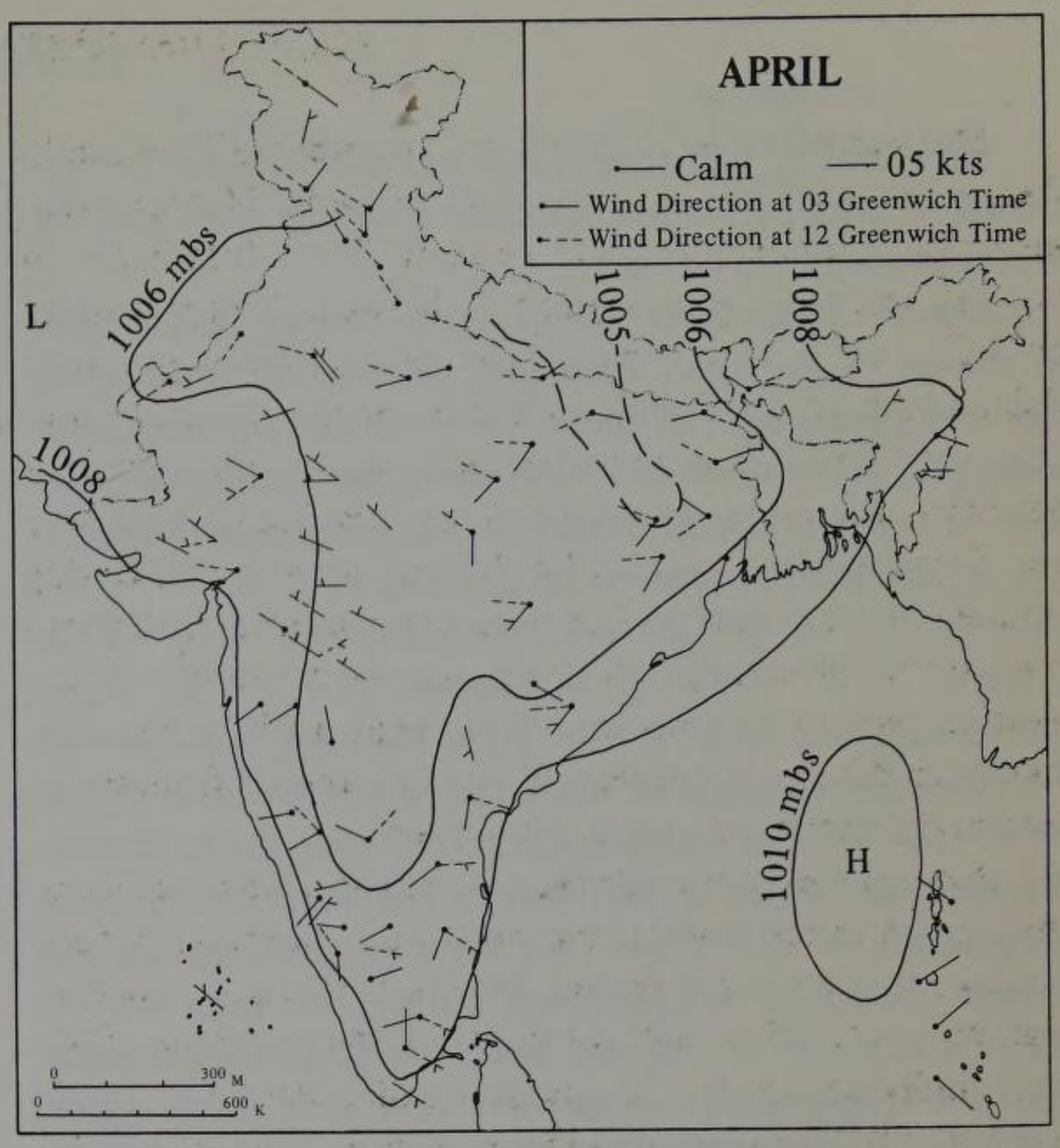
The stable weather conditions are disturbed at intervals by western depressions, accompanied by clouding and the rise in temperature in front of them, while in the rear, dry, clear weather prevails with stronger westerly to northwesterly winds bringing a spell of colder weather. The mean direction of surface wind varies from northerly to northwesterly in north India and southwesterly to westerly in south India.

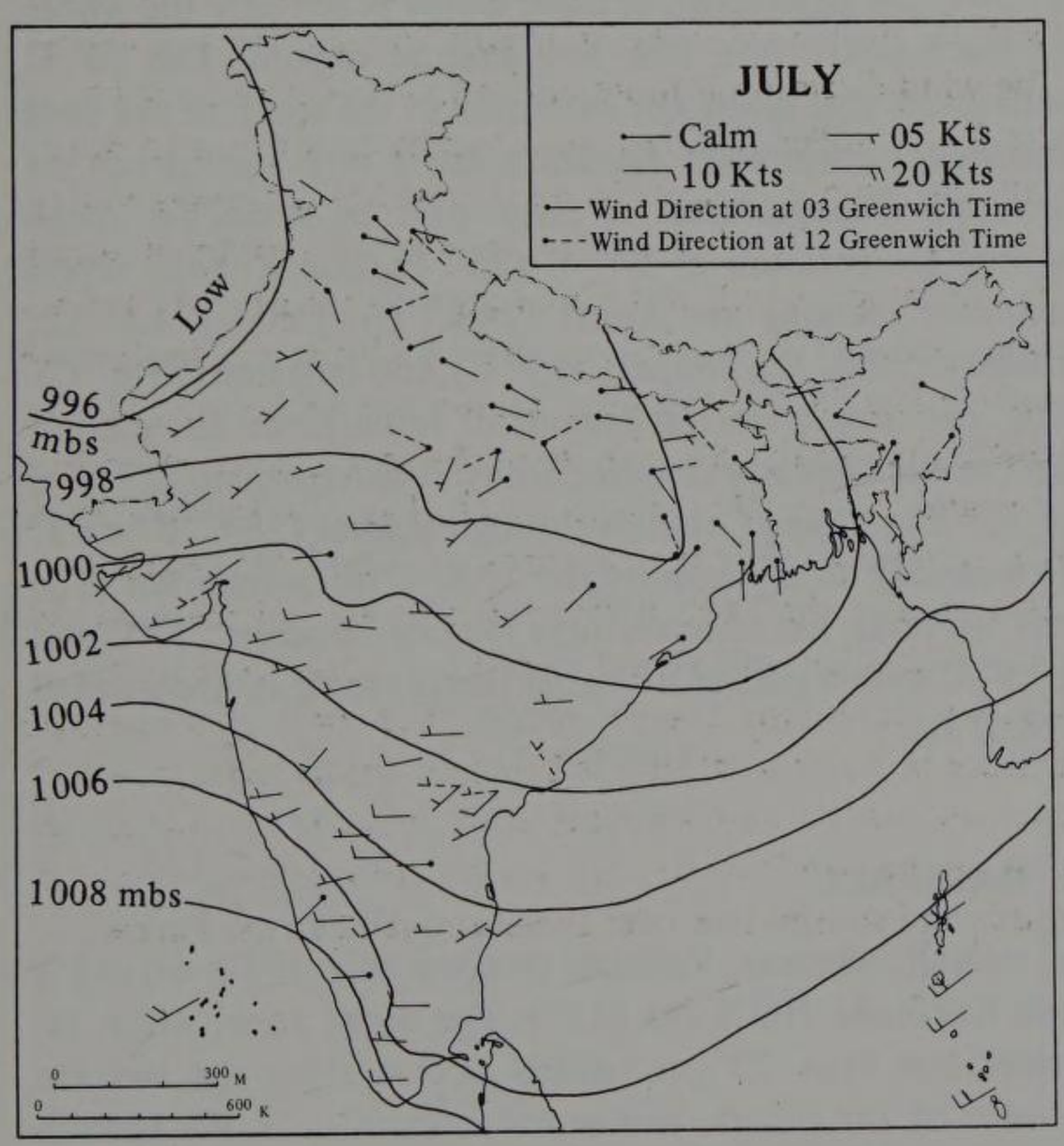
*April.* In April, a representative month of the hot weather period, a continuous and rapid rise of temperature and fall of barometric pressure occurs in north India. The area of lowest air pressure (1,005 mbs) lies over northwest India with a trough stretching to the Chotanagpur Plateau. Around this trough local circulation of air sets in during the period of rising temperature and decreasing air pressure. As a result indraughts of southern winds from the adjacent seas affect the West Bengal coast and northwesterly winds across the Bombay coast. Violent local storms often form in regions where humid winds from the sea meet hot, dry land winds. These storms are accompanied by torrential rain and hail, sometimes attaining tornadic intensity and becoming destructive. They are called Norwesters in West Bengal because the accompanying squalls usually come from that direction. In the drier parts of north India dust storms are also a common occurrence. The mean direction of wind is influenced by the orographical features, southeasterly near Delhi, Bareilly, and Jaipur, and northeasterly around Bangalore and Hyderabad.

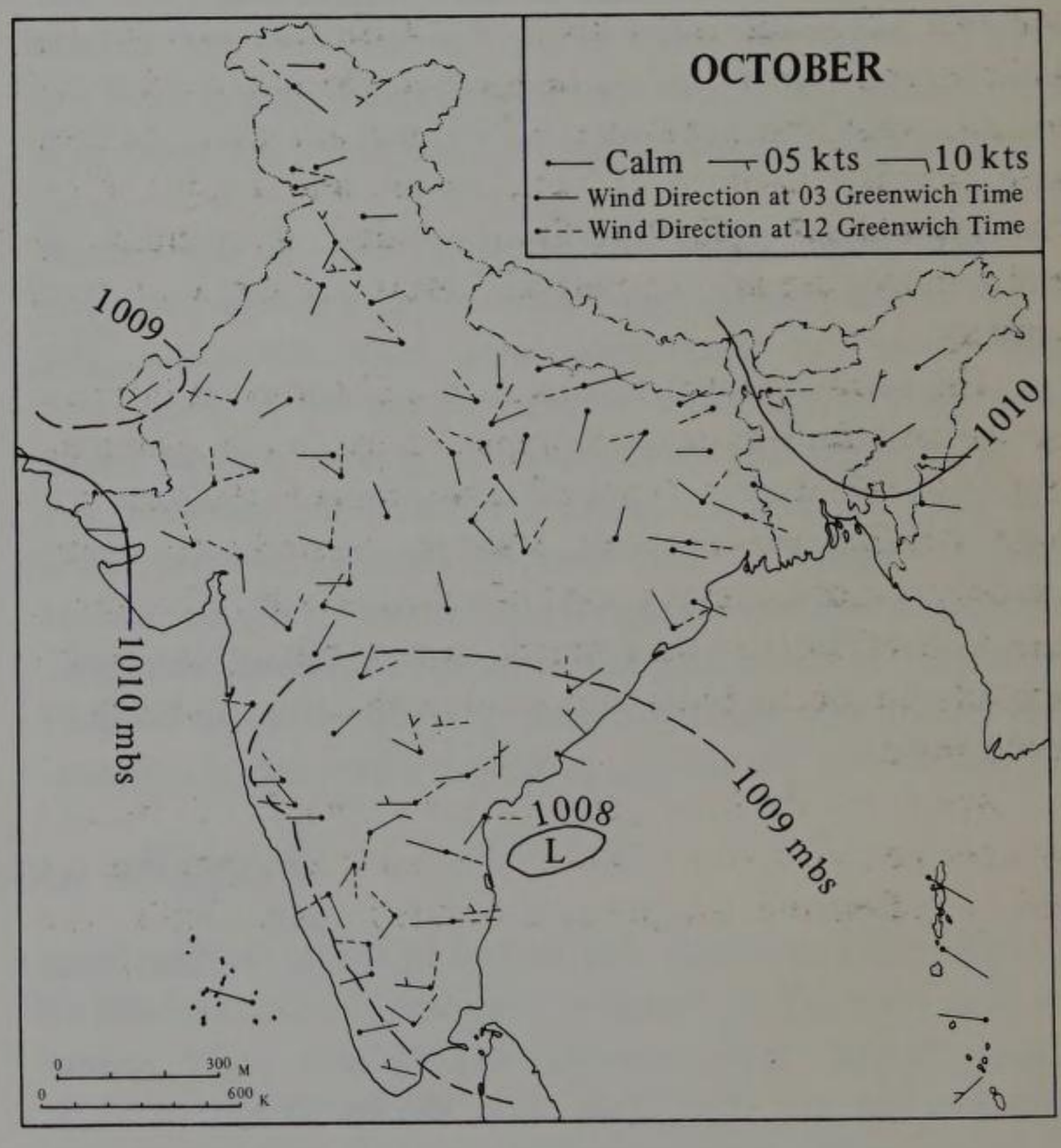
*July.* By July the barometric pressure reaches its lowest point. Cyclonic depressions which occasionally form during this month at the head of the Bay of Bengal tend to travel along the axis of the monsoon trough; during their passage west to northwest they intensify the monsoon currents. The wind direction is more uniform in this month. South of the 24° parallel it blows from southwest or east to northeast, and from southeast to northwest in the Ganges Valley.

*October.* October is a representative month of transition between southwest (hot) and northeast (cold) monsoon periods. The low-pressure conditions prevailing in north India in the monsoon season are obliterated by October. Practically the whole of India lies between 1,011 mbs and 1,012 mbs isobaric lines. The Arabian branch of the monsoon retreats southwards from the Rajasthan, Gujarat, and the Deccan by a series of intermittent actions, while the Bay of Bengal current retreats comparatively steadily down the Ganges plains. The most characteristic feature of this month is the beginning of the withdrawal of the southwest monsoon from India and the gradual extension of the winds of the dry season from north India eastwards and southwards over the entire land and sea areas.


JANUARY
Calm
05 kts
10 kts
Wind Direction at 03 Greenwich Time
Wind Direction at 12 Greenwich Time
1018 mbs
High
1016 mbs
1016
1014 mbs
1014
1012 mbs
0 300 M
0 600 K


APRIL
Calm
05 kts
Wind Direction at 03 Greenwich Time
Wind Direction at 12 Greenwich Time
L
1006 mbs
1008
1005
1006
1008
1010 mbs
H
0 300 M
0 600 K


JULY
Calm
05 Kts
10 Kts
20 Kts
Wind Direction at 03 Greenwich Time
Wind Direction at 12 Greenwich Time
Low
996 mbs
998
1000
1002
1004
1006
1008 mbs
0 300 M
0 600 K


OCTOBER
Calm
05 kts
10 kts
Wind Direction at 03 Greenwich Time
Wind Direction at 12 Greenwich Time
1009
1010
1010 mbs
1008
L
1009 mbs
0 300 M
0 600 K

## TEMPERATURE

Variations in Indian temperatures are the result of latitudinal location, elevation, distance from the seas, and the effects of mountain barriers.

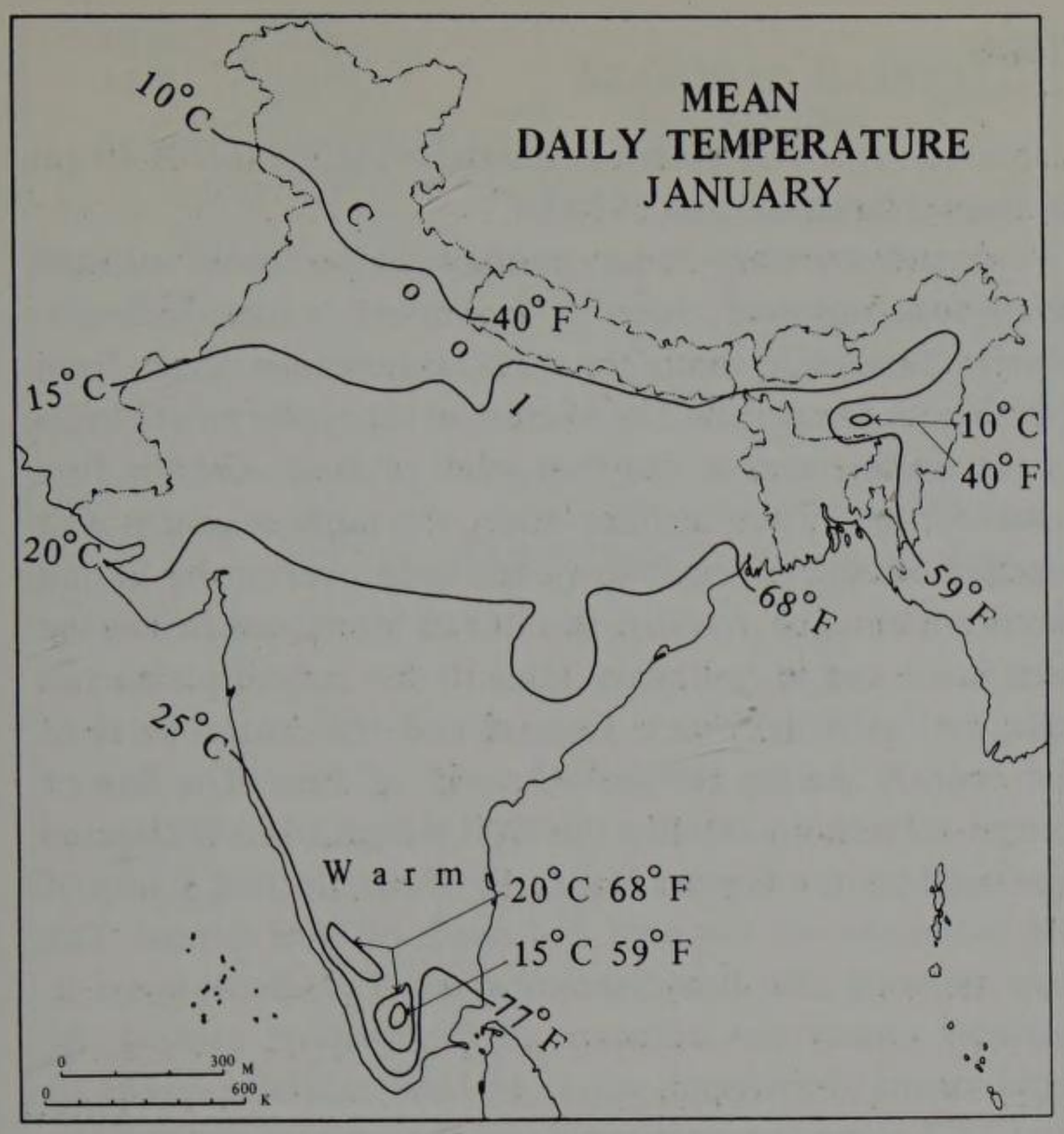
*January Mean Daily Temperature.* January is the coldest month of the year, when dry continental winds blow over the greater part of India. Temperatures increase from north (32° N) to south (8° N) showing the meridional influence on temperature distribution. The mean daily temperature is, therefore, found to range from 14.2° C (58° F) in Delhi to 26.7° C (81° F) in Trivandrum, 19.6° C (67° F) in Calcutta, 21.5° C (71° F) in Nagpur, 22.1° C (72° F) in Hyderabad, and 24.6° C (76° F) in Madras. To the north, the mountainous areas of India record temperatures below 10° C (50° F). For example, both Darjeeling in the Eastern Himalaya and Simla in the Western Himalaya have a mean temperature of 5.2° C (41° F), the average maximum and average minimum temperatures ranging between 8.6° C (47° F) and 1.9° C (35° F). India can be divided broadly into five temperature regions, very cold, cold, cool, warm, and hot, by 10° C (50° F), 15° C (59° F), 20° C (68° F), and 25° C (77° F) isothermal lines respectively, the first three of which run more or less parallel from west to east latitudinally, the fourth runs longitudinally inland from the coasts, and the fifth is a narrow band along the south and western coasts.

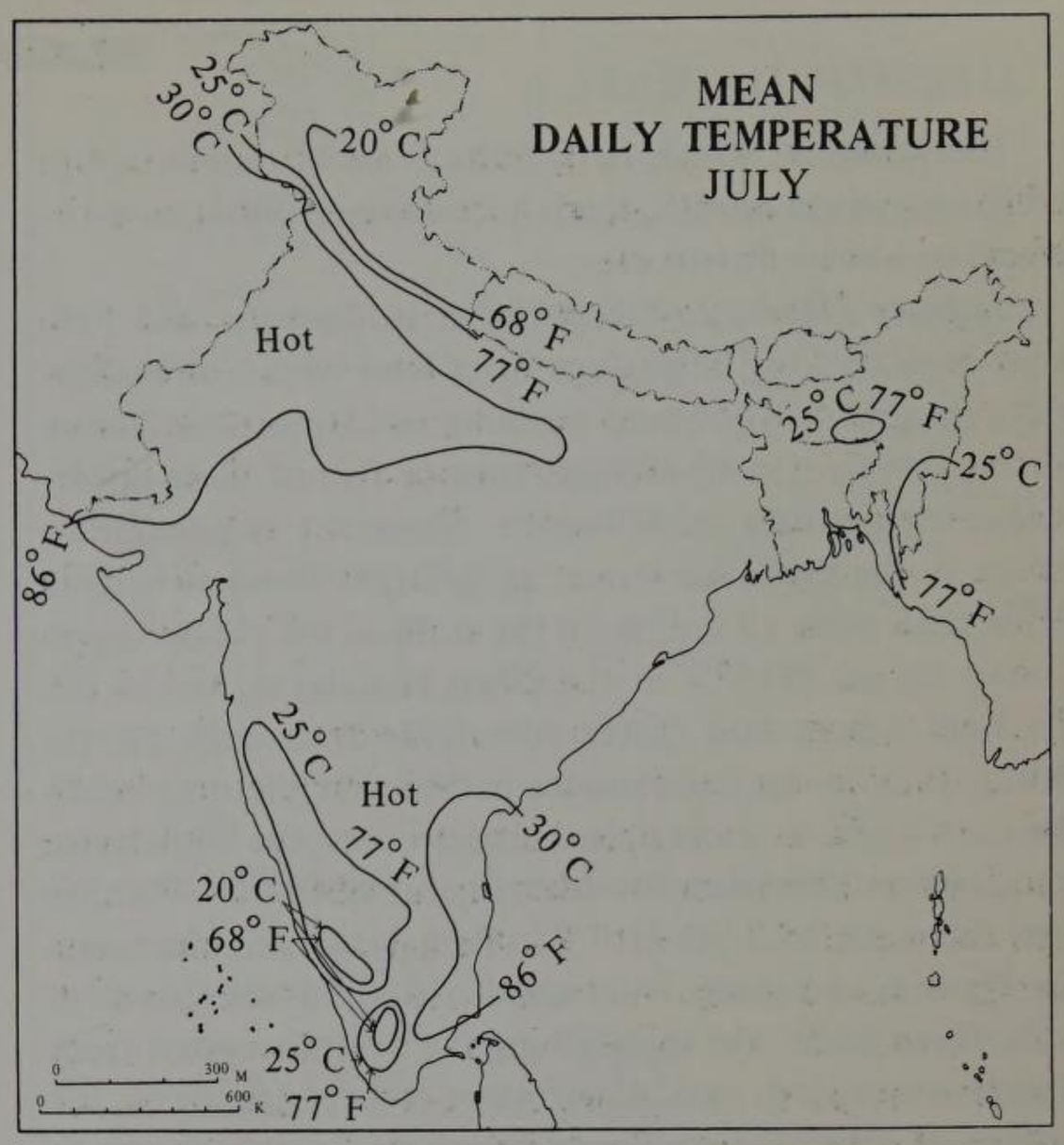
*July Mean Daily Temperature.* July is the hottest month of the year for many parts of India though monsoon rains lower the temperature after each downpour. The mean daily temperature ranges between 28° C (Pune) and 31° C (Hyderabad) throughout the greater part of India. July temperatures are uniform because the monsoon has affected almost the entire country. There is, however, some departure from the average temperatures locally because of the effects of cloud and rain from the southwest monsoon. This results in a slight lowering of temperature in Gauhati to 26.3° C (79° F), and the progressive increase of temperature with an increase of distance from the Bay: for example, Patna 29.6° C (85° F) and Varanasi 30° C (86° F). Farther west an extensive, wedge-shaped area runs from the Ganga-Yamuna Doab to the arid and semiarid lands of Punjab, Haryana, and Rajasthan where the mean July temperature rises from 30° C to over 32.5° C (91° F). This is the hottest area in July. Another hot region lies on the eastern part of Andhra Pradesh and Tamilnadu with July temperatures over 30° C (Madras 31° C). Because the southwest monsoon rain does not reach the east coast, skies remain clear and radiation is great. In contrast, there are cooler areas in the Himalayas in the north (Darjeeling 16.6° C or 62° F and Simla 18.3° C or 65° F), in Meghalaya on the east (Shillong 21.1° C or 70° F), and in the Western Ghats and adjoining plateau in the south, below 25° C (77° F).

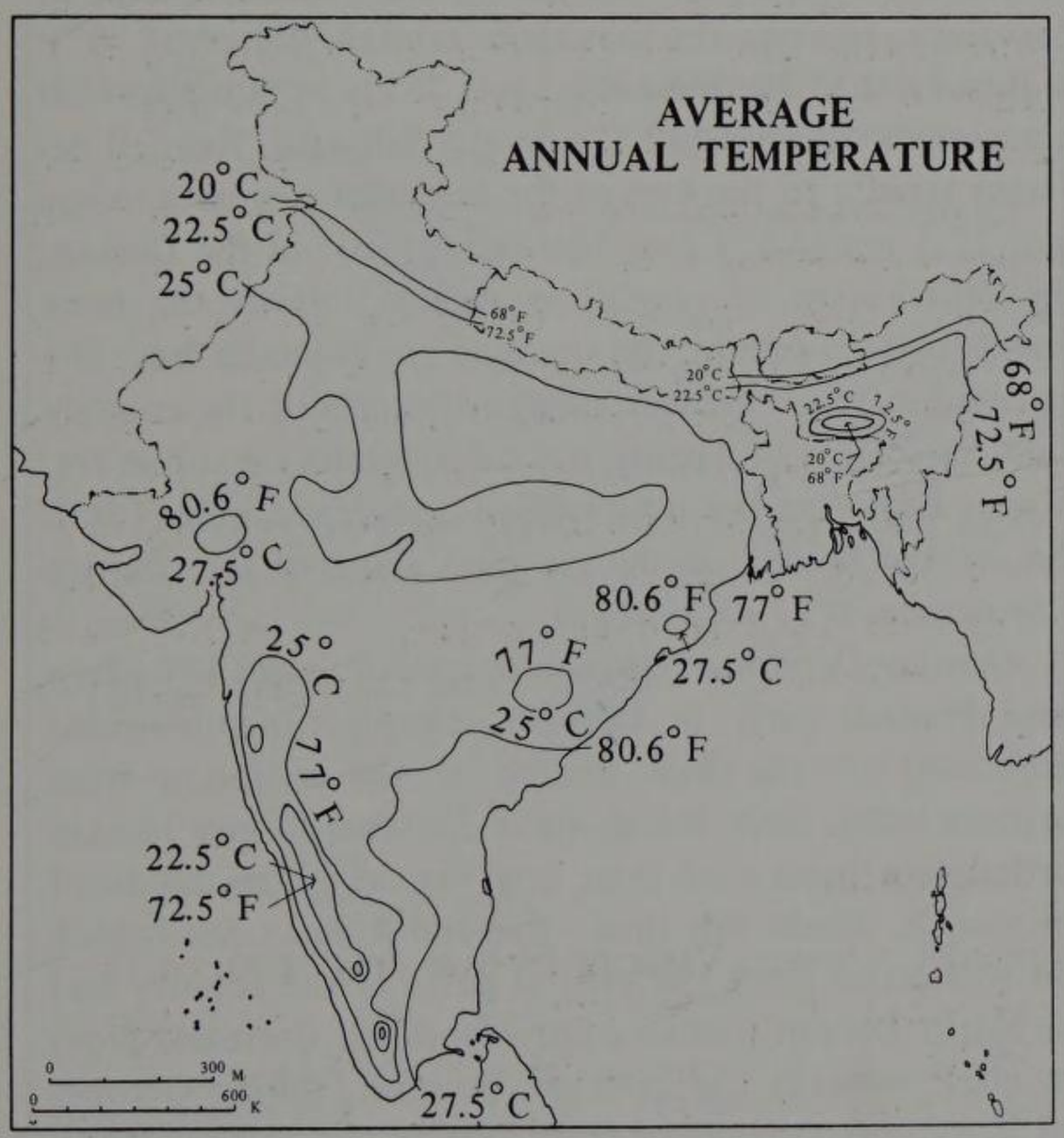
*Average Annual Temperature.* Average annual temperatures of India have been indicated on the map by isothermal lines. From the standpoint of year round temperature, three isothermal lines of the values 20° C, 25° C, and 27.5° C are significant, as these divide practically the whole of the country into four temperature regions. The 20° C isothermal line limits the extension in the south of the cool Himalaya where high elevation has a direct influence on lowering temperatures. A large part of India has mean annual temperature of 24° C (75° F). Some of the representative stations are Ajmer (24.8° C), Delhi (24.8° C), Gauhati (24.2° C), Bhopal (24.9° C), and Belgaum (23.6° C). The year round hottest regions of India lie on the eastern part of the Deccan extending from Visakhapatnam (27.5° C or 82° F) to Cape Comorin through Madras (28.6° C or 83° F) bounded on the west by the 27.5° C isothermal line. The rest of India has temperatures ranging between 25° C and 27.5° C with a pocket of higher temperature at Ahmadabad (28.2° C).

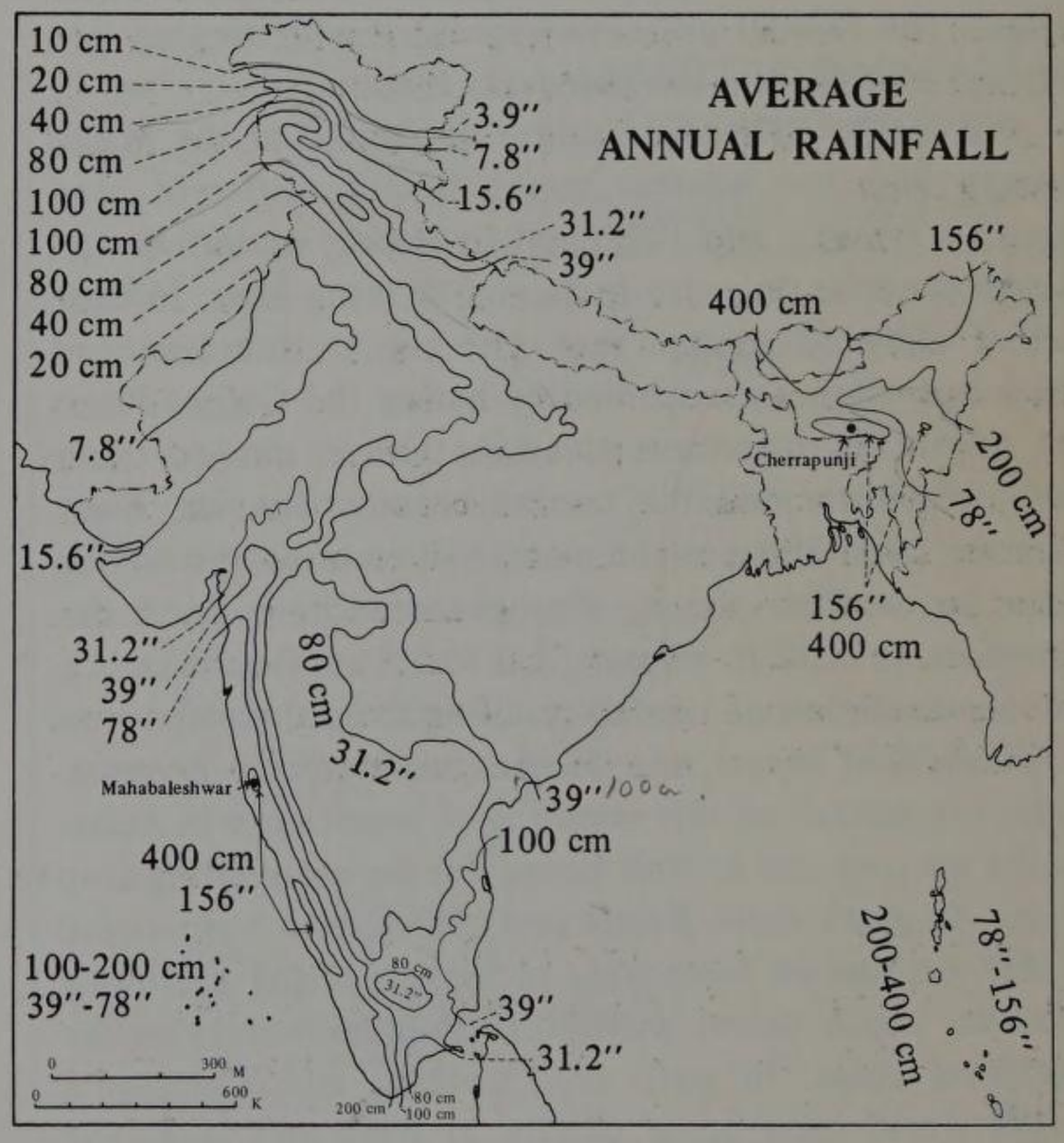
## AVERAGE ANNUAL RAINFALL

Rainfall is unevenly distributed in India, ranging from less than 10 cm (Leh, 9 cm) to over 400 cm. On the basis of annual rainfall India can be divided into eight zones: (a) below 10 cm (less than 4″); (b) 10-20 cm (4″-8″); (c) 20-40 cm (8″-16″); (d) 40-80 cm (16″-32″); (e) 80-100 cm (32″-39″); (f) 100-200 cm (39″-78″); (g) 200-400 cm (78″-156″); and (h) above 400 cm. Of these, the humid zone (39″-78″) extending continually from West Bengal and Bihar on the east to parts of Madhya Pradesh on the west and Andhra Pradesh on the south is the largest in area. It also stretches northward towards the Western Himalaya, and extends into the Assam Valley and Manipur, and into the eastern part of Tamilnadu. The 100 cm (39″) isohyetal line separates it from the drier regions in the west and south. Rainfall within the belt decreases westward and southward. For example, Calcutta receives 162.5 cm (63″) of rainfall, whereas, Varanasi receives only 107.6 cm (42″) and Kakinada 109.5 cm (43″). The driest zone, which receives less than 10 cm rainfall occurs along the western border of the desert, and more extensively in the Ladakh Plateau to the east of Karakoram Mountains. In contrast to these arid lands, the mountains and plateaus of Assam and the neighboring states and the windward side of the Western Ghats receive very heavy rainfall. It is here that all the isohyetal lines of the values 200 cm to 400 cm and above are found to coalesce, because of the effect of these landforms. It is in these areas that two of the stations recording the highest rainfall are located; Cherrapunji (almost 450″) on the southern edge of the Meghalaya Plateau and Mahabaleshwar (243″) on the western edge of the Western Ghats.


MEAN
DAILY TEMPERATURE
JANUARY
10°C
40°F
15°C
10°C
40°F
20°C
68°F
59°F
25°C
Warm
20°C 68°F
15°C 59°F
77°F
0 300 M
0 600 K


MEAN
DAILY TEMPERATURE
JULY
25°C
30°C
20°C
Hot
68°F
77°F
25°C 77°F
25°C
86°F
77°F
25°C
Hot
77°F
30°C
20°C
68°F
86°F
25°C
77°F
0 300 M
0 600 K


AVERAGE
ANNUAL TEMPERATURE
20°C
22.5°C
25°C
68°F
72.5°F
20°C
22.5°C
22.5°C
72.5°F
20°C
68°F
68°F
72.5°F
80.6°F
27.5°C
80.6°F
77°F
77°F
27.5°C
25°C
80.6°F
25°C
77°F
22.5°C
72.5°F
27.5°C
0 300 M
0 600 K


AVERAGE
ANNUAL RAINFALL
10 cm
20 cm
40 cm
80 cm
100 cm
100 cm
80 cm
40 cm
20 cm
3.9"
7.8"
15.6"
31.2"
39"
156"
400 cm
7.8"
15.6"
31.2"
39"
78"
Mahabaleshwar
400 cm
156"
100-200 cm
39"-78"
Cherrapunji
200 cm
78"
156"
400 cm
80 cm
31.2"
39"/100 cm
100 cm
39"
31.2"
200 cm
80 cm
100 cm
78"-156"
200-400 cm
0 300 M
0 600 K

## PRECIPITATION

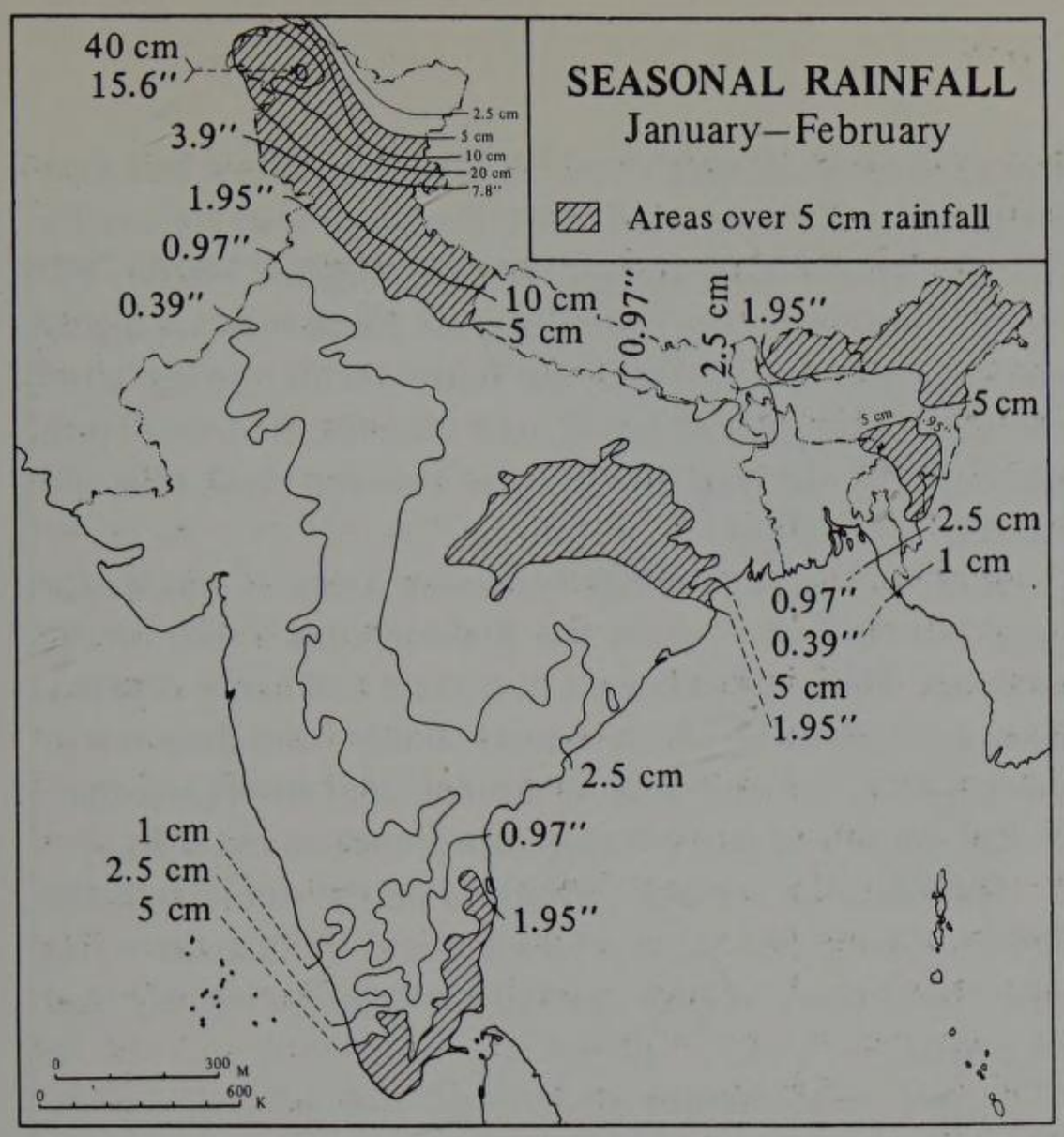
Precipitation, which falls in the form of rain except in the Himalayas in winter, tends to be seasonally oriented in the pattern of its distribution.

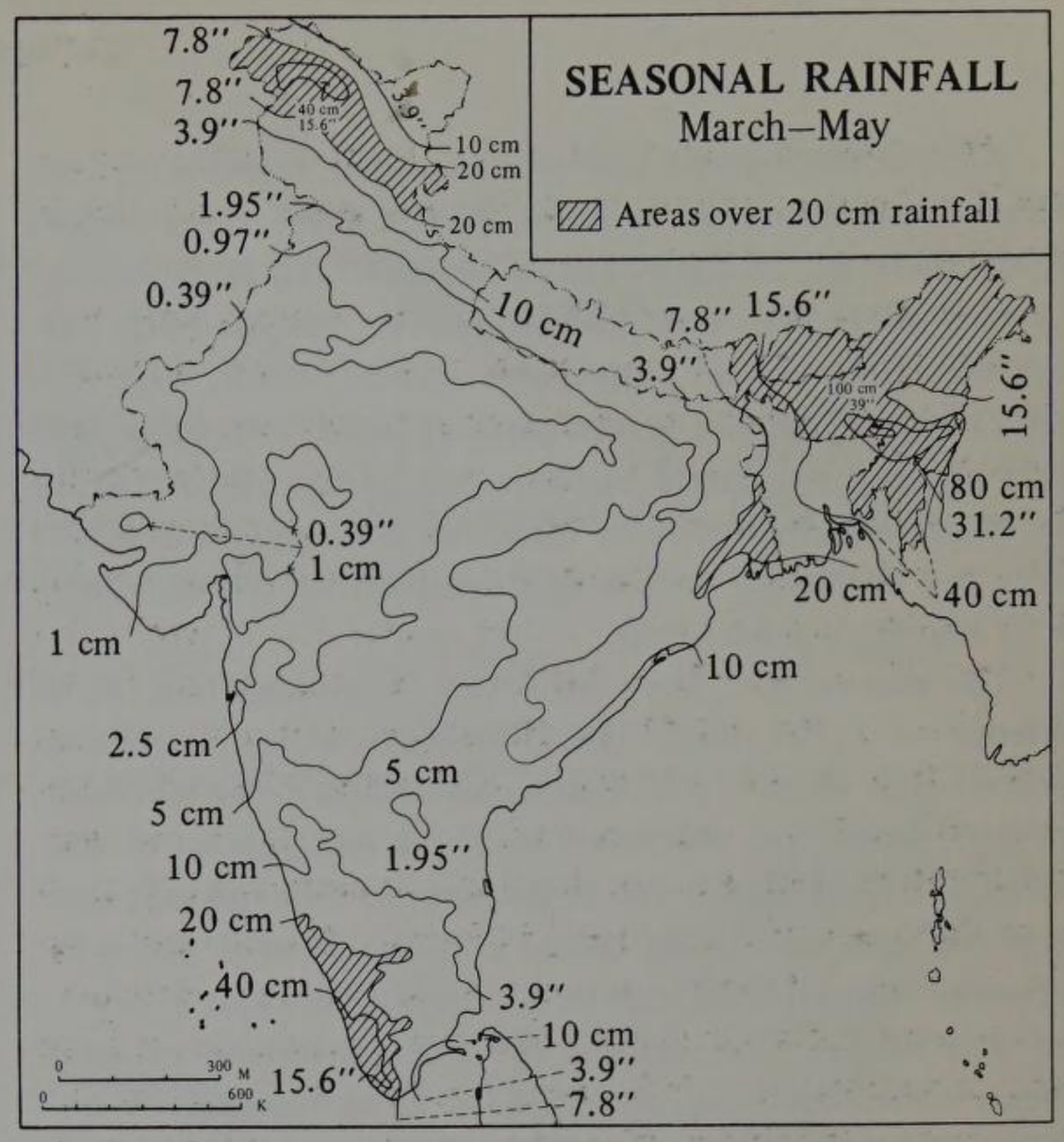
*January-February.* Precipitation in January and February is related to the passage from west to east of shallow but extensive low-pressure systems or depressions across northern India. On an average, four or five of these disturbances enter India each month. Since the condensation occurs in the upper air strata, at different levels at heights above 1.86 miles (3 km) from the surface, the precipitation is over 30 cm (11.7″) in the Great Himalayas, and in the less high Lesser and Outer Himalayas it is only 10 cm (3.9″). It is in the cold winter period that the main additions are made to snow accumulations over the Himalayas. Precipitation decreases southwards and eastwards. Rainfall is of the order of 5 cm (1.9″) in Punjab, Assam, Chotanagpur Plateau, and varies from about 1.8 to 5.0 cm elsewhere in northern India. On approaching the southeast coast from Madras southward, rainfall increases to over 10 cm by the passage of retreating southwest monsoon currents in association with cyclonic storms and depressions from the Bay of Bengal. The rainfall decreases rapidly inland, so that it is only 2.5 cm (.98″) in the Karnataka Plateau.

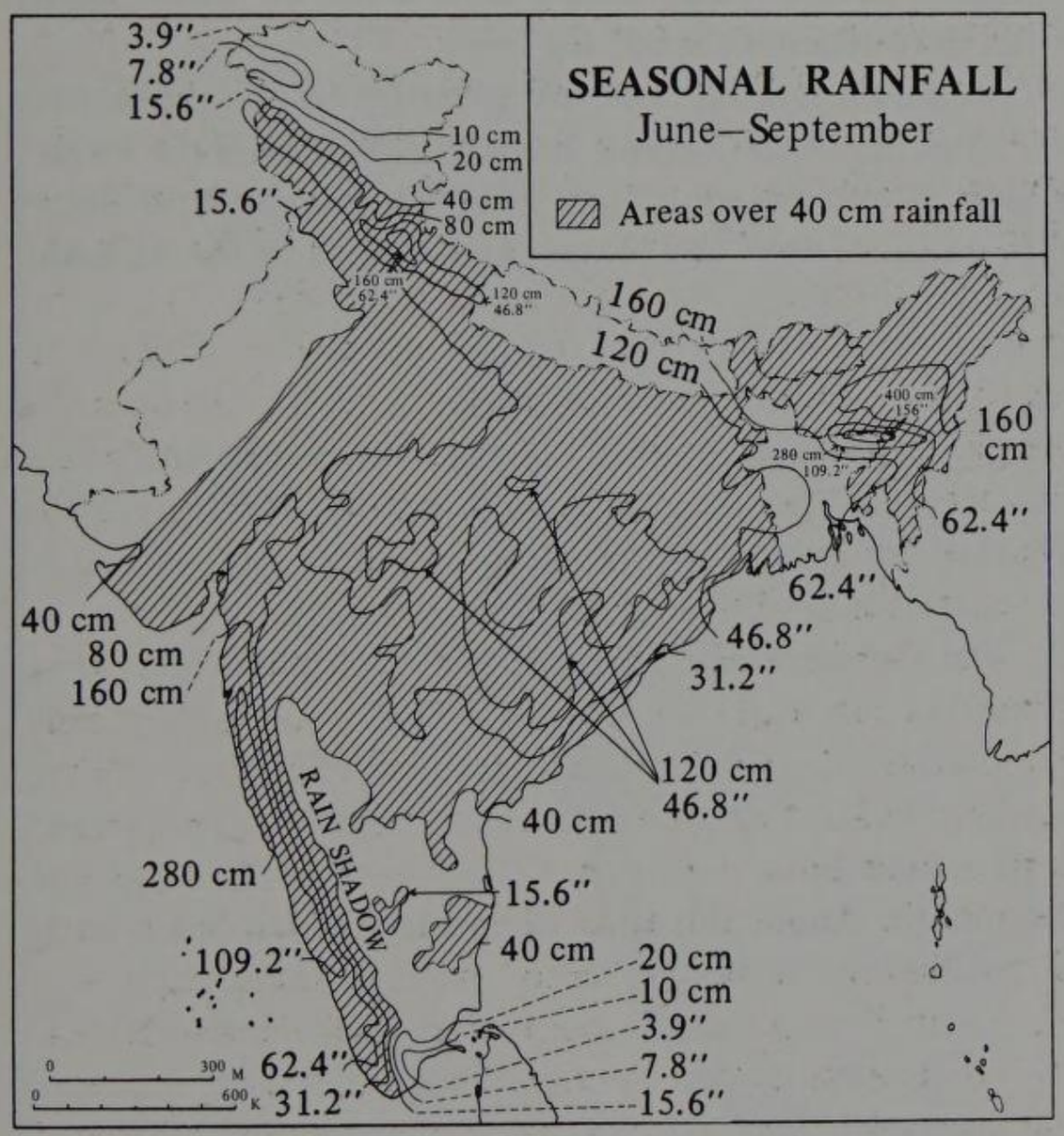
*March-May.* The distribution of rainfall in the March through May hot weather season is quite different compared to January and February. In March, western disturbances continue to enter India and to bring rains. In their further eastward passage they give rise to thunderstorms which are often accompanied by hail in the Ganges Plains and Assam. As the season advances, thunder showers occur more frequently and the rainfall becomes heavier. Away from the coast in the inland plains and plateaus, the rainfall in the hot weather period, often preceded by cyclonic disturbances, is small in amount, 1.0 to 2.5 cm (less than 1″). The accumulation of rainfall resulting from thunderstorms in Assam, West Bengal, and Orissa is much greater. Economically, the rainfall of this season is of importance in Assam for the tea crop and in West Bengal for the early spring crop of rice. In south India, Kerala gets moderate to high rainfall in May because of temporary incursions of the southwest monsoon which causes widespread thundershowers on the southwest coast. In parts of Karnataka and Tamilnadu, thunderstorm rains occur chiefly in April and May. The distribution is irregular and the amount averages about 7.5 to 10 cm (2.9″-3.9″). In north India this is a period of day winds with little or no rainfall until the end of the season when temporary incursions of the monsoon winds give rise to premonsoon thunderstorms. The total rainfall of the period is less than 2.5 cm in Rajasthan, Gujarat, and Madhya Pradesh and it varies between 5 and 14 cm (1.9″ to 5.5″) in the submontane areas in north Bihar, parts of West Bengal and Orissa, and over the greater part of the peninsula. It is over 20 cm in Kerala, while it exceeds 40 cm in the northeastern part of India.

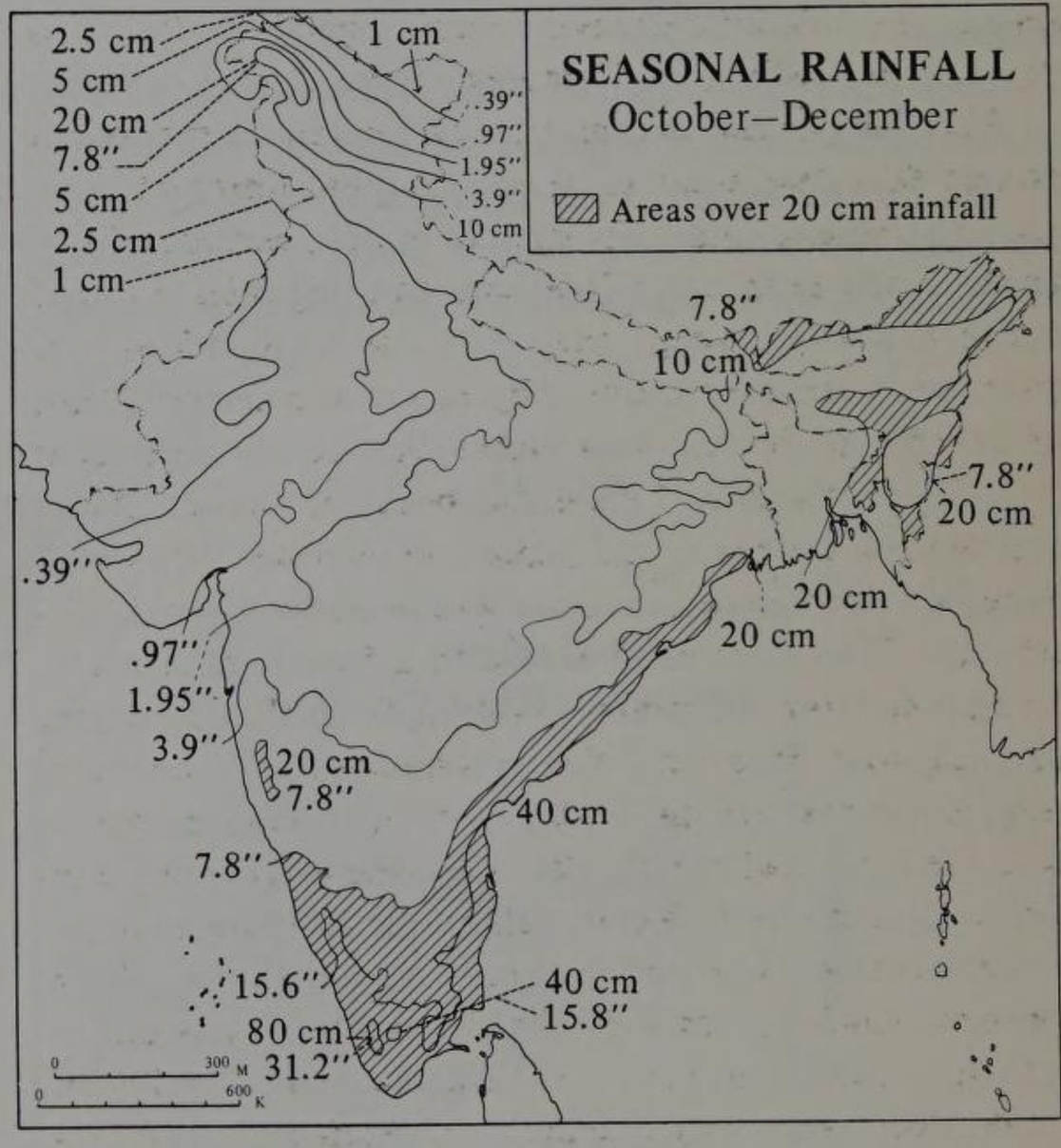
*June-September.* India's rainiest season comes with the southwest monsoon, June to September, except in southeastern Tamilnadu where the main rainy season occurs from October to December. The southwest monsoon enters India in two main currents: the first week of June, and the first week of July. It is in July, when the rainy season is well established, the entire country has been overrun by humid monsoon air. The Arabian Sea line of monsoons strikes the west coast and brings heavy rains to the coastal plains and hills, and eventually into Gujarat and the central parts of the country during the second week of June. The Bay of Bengal current on crossing the West Bengal coast is directed westward up the Ganges Valley by the deflecting action of the mountains to the west and north of West Bengal. The map showing the June-September rainfall distribution illustrates clearly the influence of topography, causing the rapid ascent of monsoon winds. In June, rainfall exceeds 70 cm (27″) along the west coast and the western scarp of the Sahyadri (Mahabaleswar 32 cm or 12″). Cherrapunji, in Meghalaya, receives the maximum rainfall 400 cm (156″). In July most of the west coast gets 76 cm of rainfall which increases to 127 cm (32.5″) on the Sahyadri. Rainfall decreases rapidly to the east of the Sahyadri, lowering to less than 12.5 cm (4.9″) over the eastern part of the Deccan. The distribution of rainfall in August follows the same general pattern except the amounts are generally less. The distribution of September rainfall throughout the country is similar to that of August, but the amounts are still lower. In west Rajasthan the total rainfall is less than 5 cm (1.9″). The average rainfall on the northern plains of the country in September is 17.8 cm (6.9″).

*October-December.* Monsoon rainfall ceases in eastern Uttar Pradesh early in October. During the subsequent withdrawal of the Bay Branch of the monsoon from northern India, these moist winds continue to give rains in northeastern India until their final retreat by the middle of the month. About this time when the Arabian Sea branch also withdraws from the central parts of the country and the North Deccan, the amount of rainfall decreases from the coast towards the interior. However, during October and November cyclonic storms form in the Bay of Bengal and carry heavy rainfall along their track. The Deccan, and especially the coastal districts of Tamilnadu, receive most of their rainfall in this season. In October, rainfall exceeds 25 cm (10″) along the Tamilnadu and Kerala coastal plains. In November the total rainfall is between 25 cm (10″) and 37.5 cm (15″) on the Tamilnadu coastal plains. The retreating southwest monsoon continues to give occasional rain in December on the east coast of the South Deccan in association with cyclonic storms and depression from the Bay of Bengal.


SEASONAL RAINFALL
January–February
Areas over 5 cm rainfall
40 cm
15.6"
3.9"
1.95"
0.97"
0.39"
10 cm
5 cm
2.5 cm
1 cm
0 300 M
0 600 K


SEASONAL RAINFALL
March–May
Areas over 20 cm rainfall
7.8"
3.9"
1.95"
0.97"
0.39"
10 cm
20 cm
40 cm
80 cm
31.2"
15.6"
5 cm
2.5 cm
1 cm
0 300 M
0 600 K


SEASONAL RAINFALL
June–September
Areas over 40 cm rainfall
RAIN SHADOW
160 cm
120 cm
62.4"
46.8"
31.2"
40 cm
80 cm
280 cm
109.2"
15.6"
20 cm
10 cm
7.8"
3.9"
0 300 M
0 600 K


SEASONAL RAINFALL
October–December
Areas over 20 cm rainfall
2.5 cm
5 cm
20 cm
7.8"
1 cm
.39"
.97"
1.95"
3.9"
10 cm
80 cm
31.2"
15.6"
40 cm
15.8"
0 300 M
0 600 K

## SOILS

All the three major soil groups, zonal, intrazonal, and azonal are represented in India. Within these three major groups there are 25 subgroups of which 10 fall under zonal, 8 under intrazonal, and 7 under azonal. Though India has thirteen different soil types, the alluvial, black, and red types cover by far the greater part of India. Two other soil types occupy peripheral regions: one in the Himalayas in the north called mountain meadow soils and brown hill soils, and the other on the arid lands in the West, collectively known as desert soils.

The *alluvial soils* have the largest longitudinal extent, a distance of 1,500 miles. The Great Plain of north India is covered with these types of soils, derived from the alluvium brought down and deposited by the river systems of the Indus, the Ganges, and the Brahmaputra. Alluvial soils also occur on the east coast deltas and the coastal plains in between. Alluvial soils, rich in potash but deficient in nitrogen and humus, are suitable for the cultivation of rice, wheat, corn, sugarcane, and oilseeds. A narrow belt of immature soils (the Terai soils) with decomposed plant residue occurs in the piedmont plain, bordering the foothills of the Himalaya.

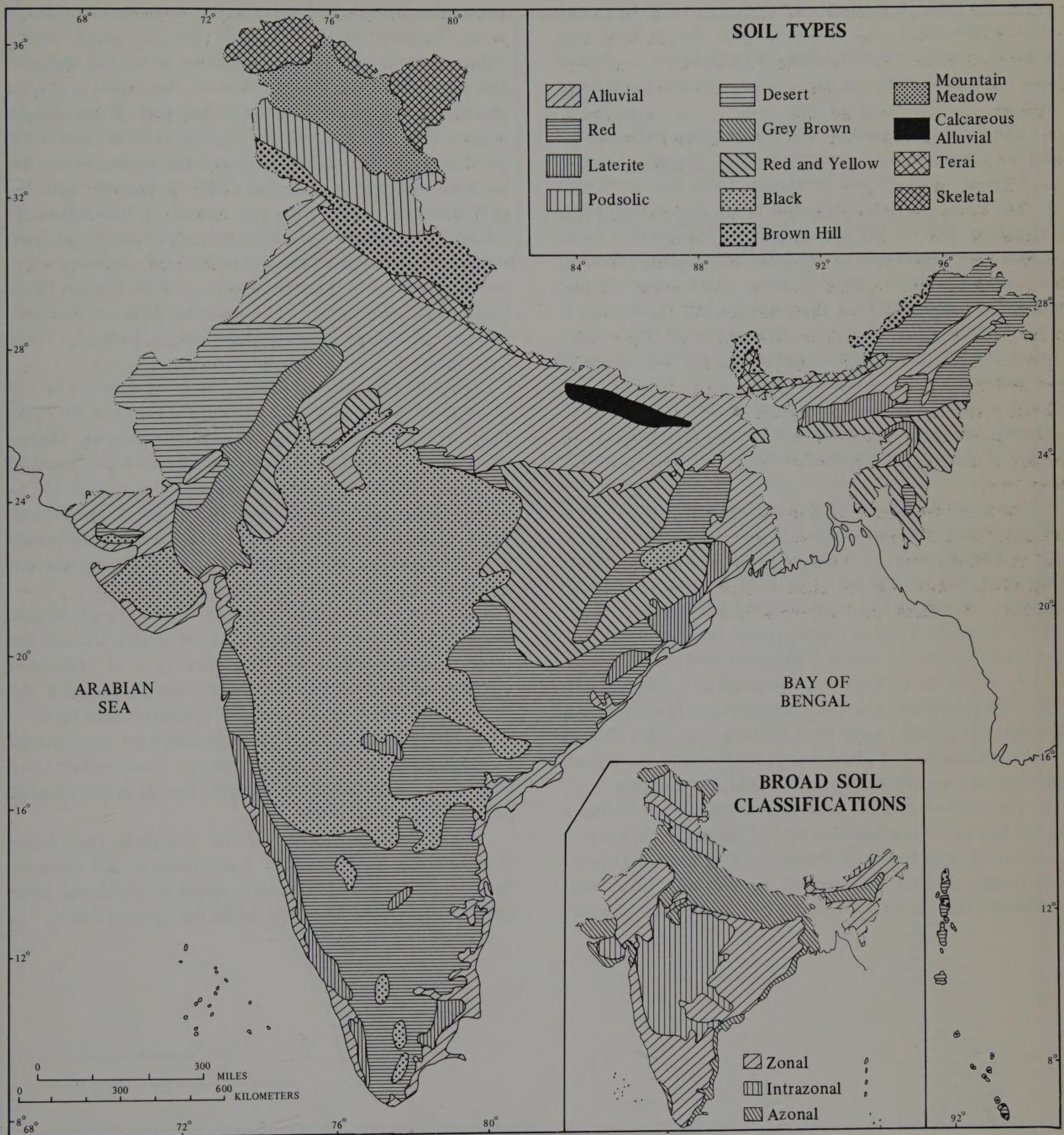
*Black soil* (regur), derived mainly from basic lava flows (basalt), forms the most extensive soil cover in central India and the North Deccan. Four types of black soils occur: deep black, medium black, shallow black, and mixed red and black. Of these, medium black soils have the greatest extent; deep black soils occur in the river valleys, and shallow black soils occur in patches. The black soils are usually deficient in nitrogen, phosphoric, and organic matter, but are rich in potash, iron, and lime. All black soils are highly retentive of moisture and are fairly fertile, giving good yields of cotton, food grains, and oilseeds. Red and black soils occur in the transitional areas between black soils and red soils.

*Red soils* occur on the remaining areas of peninsular India, but they also border the Brahmaputra Valley on the northeast. These soils are light in texture and easily drained. Some of these soils, which exhibit shades from deep red to brown yellow-red and yellow, are deficient in organic matter. Chiefly dry or rain-fed crops are grown on red soils.

*Laterite soils* are well developed on the summits of the Western Ghats and parts of Orissa and Tamilnadu states under conditions of high rainfall and alternating dry and wet periods.

*Desert soils,* formed under arid and semiarid conditions, occupy a large tract in western Rajasthan. Elsewhere, especially in the Thar, desert soils occur on wind-blown sands, derived from the old sea coast.

*Mountain and hill soils* are governed by the characteristic deposits of the organic matter derived from the forest growth in the mountains and hills. Further north, skeletal soils occur in the Karakoram Mountains and the Ladakh Plateau.


SOIL TYPES
Alluvial
Red
Laterite
Podsolic
Desert
Grey Brown
Red and Yellow
Black
Brown Hill
Mountain Meadow
Calcareous Alluvial
Terai
Skeletal
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
BROAD SOIL CLASSIFICATIONS
Zonal
Intrazonal
Azonal

## CLIMATIC REGIONS AND NATURAL VEGETATION

India has a typical monsoon climate with two seasonal winds, known as monsoons, blowing in different directions during the year. In summer the rainbearing southwest monsoon winds invade the country from the tropical seas, whereas in winter the direction of these winds is reversed (i.e., from northeast), and dry, cool continental winds begin to blow.

Based on precipitation and temperature India can be divided broadly into three types of climatic regions: (1) tropical rainy region in eastern India and southwest coastal areas; (2) the humid subtropical region occupying the greater part of the Great Plains of the north; (3) the tropical Savanna region covering the greater part of central and southern India. Besides these three main climatic regions, there are at least three subregions: mountain climate in the Himalayas; the desert climate in western Rajasthan; and the Steppe climate in parts of Rajasthan and the Deccan.

The larger section of the *tropical rainy region* lies to the east of the 88° meridian of longitude, covering the whole of Assam and the neighboring states. The other section of this climatic zone lies along the west coast of the Deccan from Bombay to Cape Comorin. In the greater part of this region, the mean annual temperature varies between 25° C (77° F) and 27° C (81° F) and the average rainfall, 200 cm (78″) to 400 cm (156″). In general, soils are alluvial in the valleys and plains but red loamy or lateritic at higher altitudes. Tropical semievergreen forests are the typical vegetation in the Assam Valley and west coastal plains, which change to tropical wet evergreen at higher altitude. The high humidity and even temperature favor vigorous vegetational growth; some trees reaching over 200′. Though very large numbers of plant species are found in this region, the common are *Messua ferrea, Michelia*, and *Eugenia.*

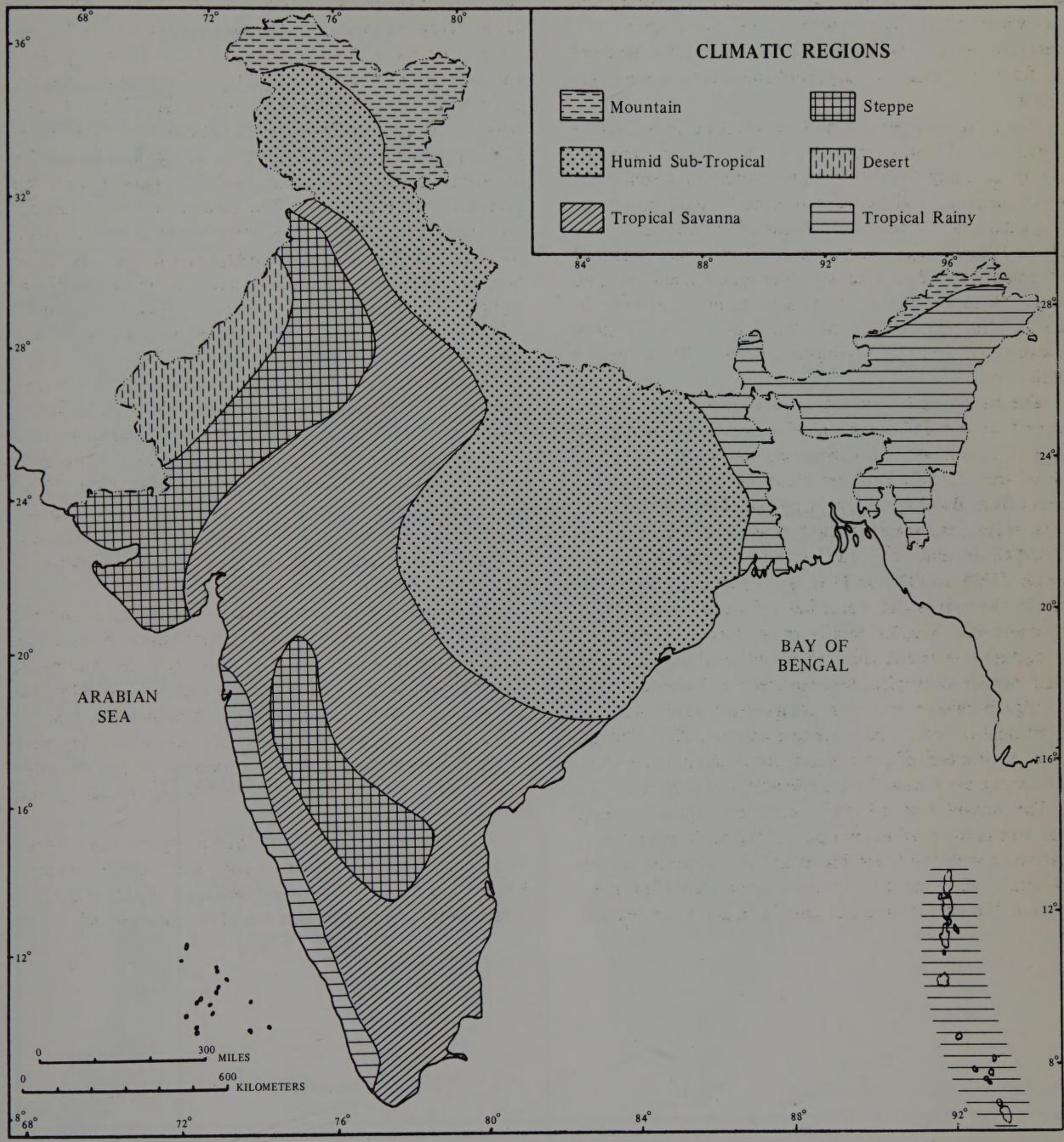
The *humid tropical and subtropical region* forms a broad belt in the northeastern part of the peninsula merging northwards with the Great Plains and the bordering mountain ranges, where annual rainfall is moderately high, ranging from 100 cm (39″) to 200 cm (78″), and mean temperature between 20° C (68° F) and 25° C (77° F). Soils are alluvial in river valleys, red, yellow, and black soils in the peninsular plateau, and brown hill soils in the Outer Himalayas. Tropical moist deciduous (or monsoon) forests, which coincide with the high reliability of rainfall regime of the central and the eastern parts of the country, are the characteristic vegetation in the greater part of this climatic region. The trees react to the climatic rhythm, new leaves starting with the onset of monsoon and premonsoon rains in April and May and actual "fall" in January with the prevalence of dry season. The forests of this region are mixed; three species have economic significance: (a) *Teak,* over most of the peninsula proper, (b) *Sal,* concentrated in two main areas, northeastern plateau and the Eastern Himalayas, and (c) *Sandalwood* in Karnataka. *Teak* and *Sal* make excellent furniture and *Sandalwood* is used for fancy carvings.

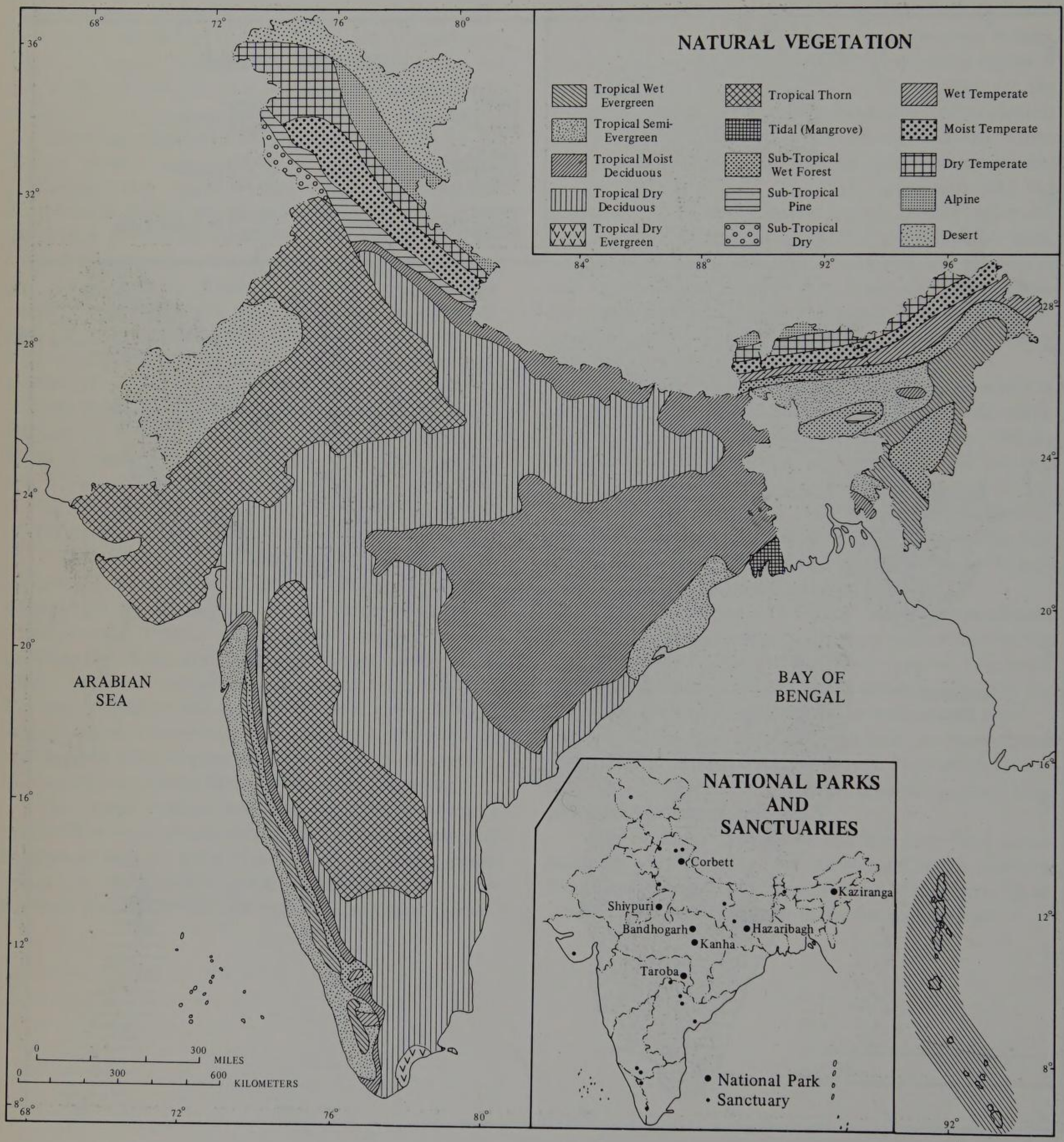
Farther west lies the *tropical Savanna region,* a belt of low rainfall, extending from the Punjab Plains in the north right across the Vindhya Range into the Deccan. The annual rainfall in this belt ranges between 60 cm (24″) and 80 cm (32″) and mean annual temperature is around 25° C. Red soils are predominant, and vegetation is the tropical, dry deciduous type. Small trees often develop enormously long roots and are often armed with sharp thorns. Various species of *Acacia* are found in this region.

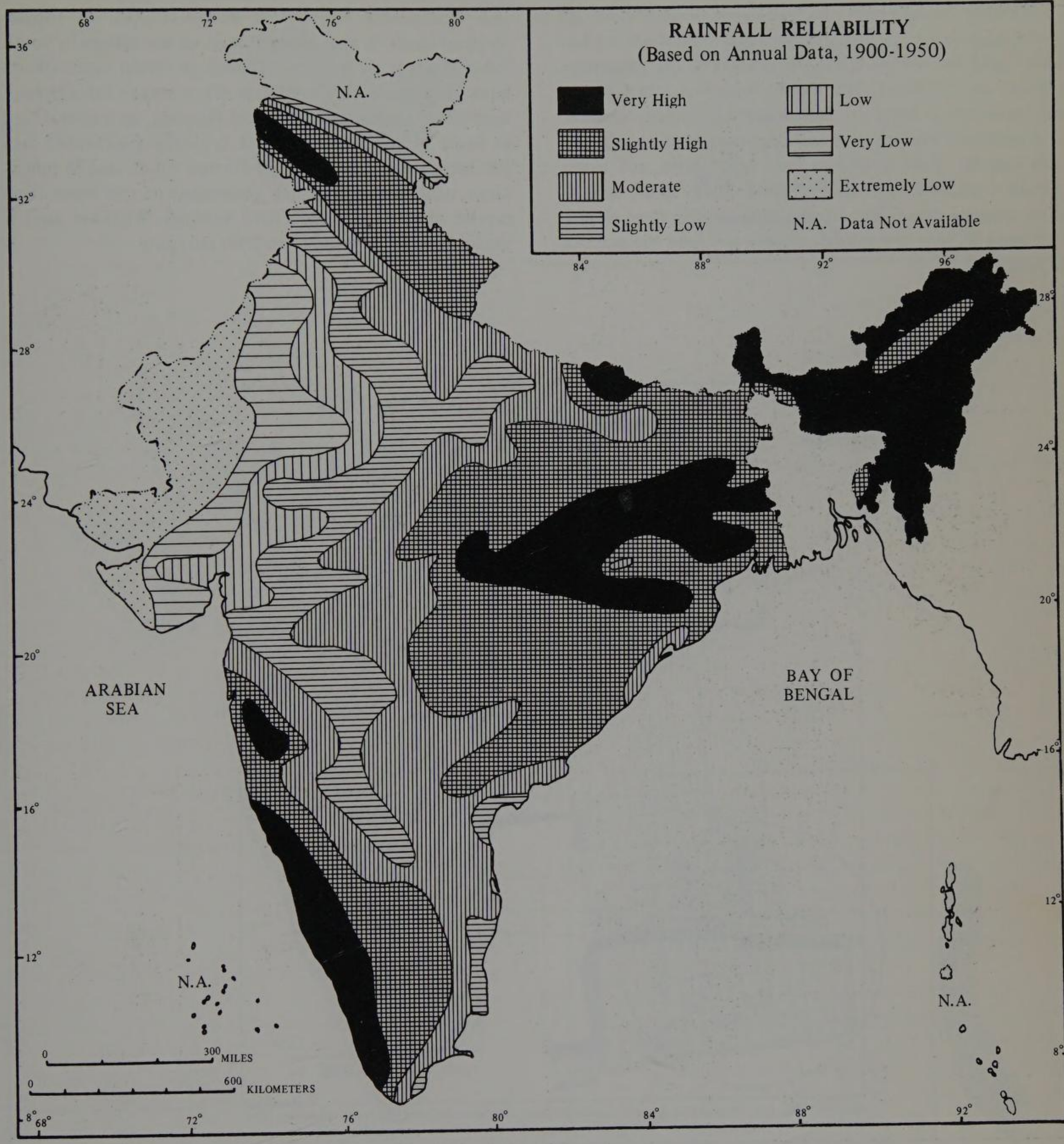
Both in Rajasthan and Deccan where *Steppe climate* prevails, short bunch grass and thorny bushes became the typical natural vegetation. The same type of vegetation interspersed with sand dunes, occurs widely scattered in the desert climate with *Acacia Catechu* as predominant type.

Subtropical pine and alpine vegetation are encountered in the higher ranges of the Himalayas. They contain valuable timber; oaks, conifers, *deodars* (*Cedrus deodara*), blue pine, silver fir, and spruce.

Tidal mangrove forests of the Everglade kind occur along the sea coasts, but the Sunderbans in the southern Bengal have the most extensive coverage of this forest. Most timber of this forest is at best useful for cooking fuel.


CLIMATIC REGIONS
Mountain
Steppe
Humid Sub-Tropical
Desert
Tropical Savanna
Tropical Rainy
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

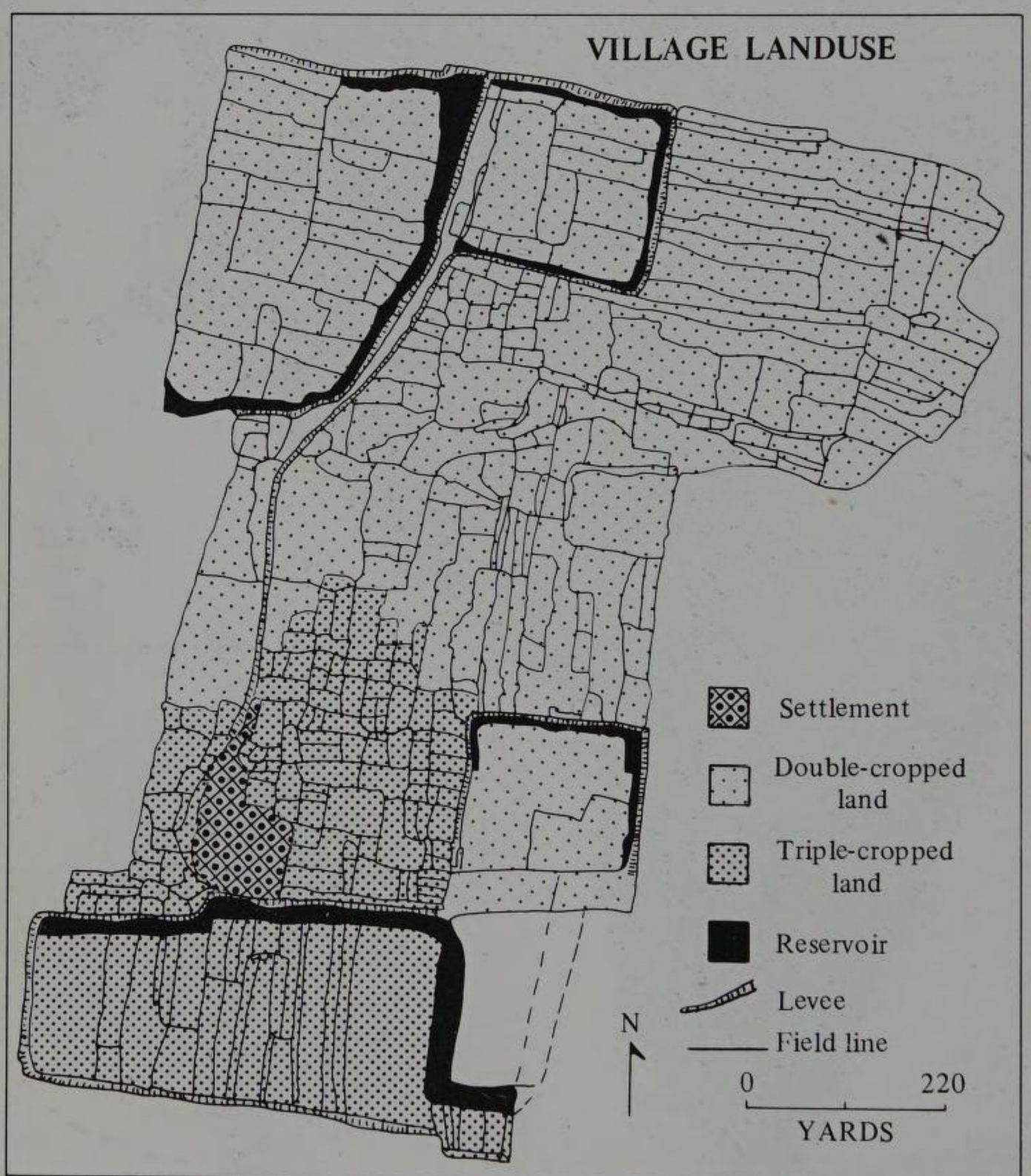

NATURAL VEGETATION
Tropical Wet Evergreen
Tropical Semi-Evergreen
Tropical Moist Deciduous
Tropical Dry Deciduous
Tropical Dry Evergreen
Tropical Thorn
Tidal (Mangrove)
Sub-Tropical Wet Forest
Sub-Tropical Pine
Sub-Tropical Dry
Wet Temperate
Moist Temperate
Dry Temperate
Alpine
Desert
NATIONAL PARKS AND SANCTUARIES
Corbett
Shivpuri
Bandhogarh
Kanha
Taroba
Hazaribagh
Kaziranga
• National Park
• Sanctuary
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°


RAINFALL RELIABILITY
(Based on Annual Data, 1900-1950)
Very High
Slightly High
Moderate
Slightly Low
Low
Very Low
Extremely Low
N.A. Data Not Available
N.A.
ARABIAN SEA
BAY OF BENGAL
N.A.
N.A.
0 300 MILES
0 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

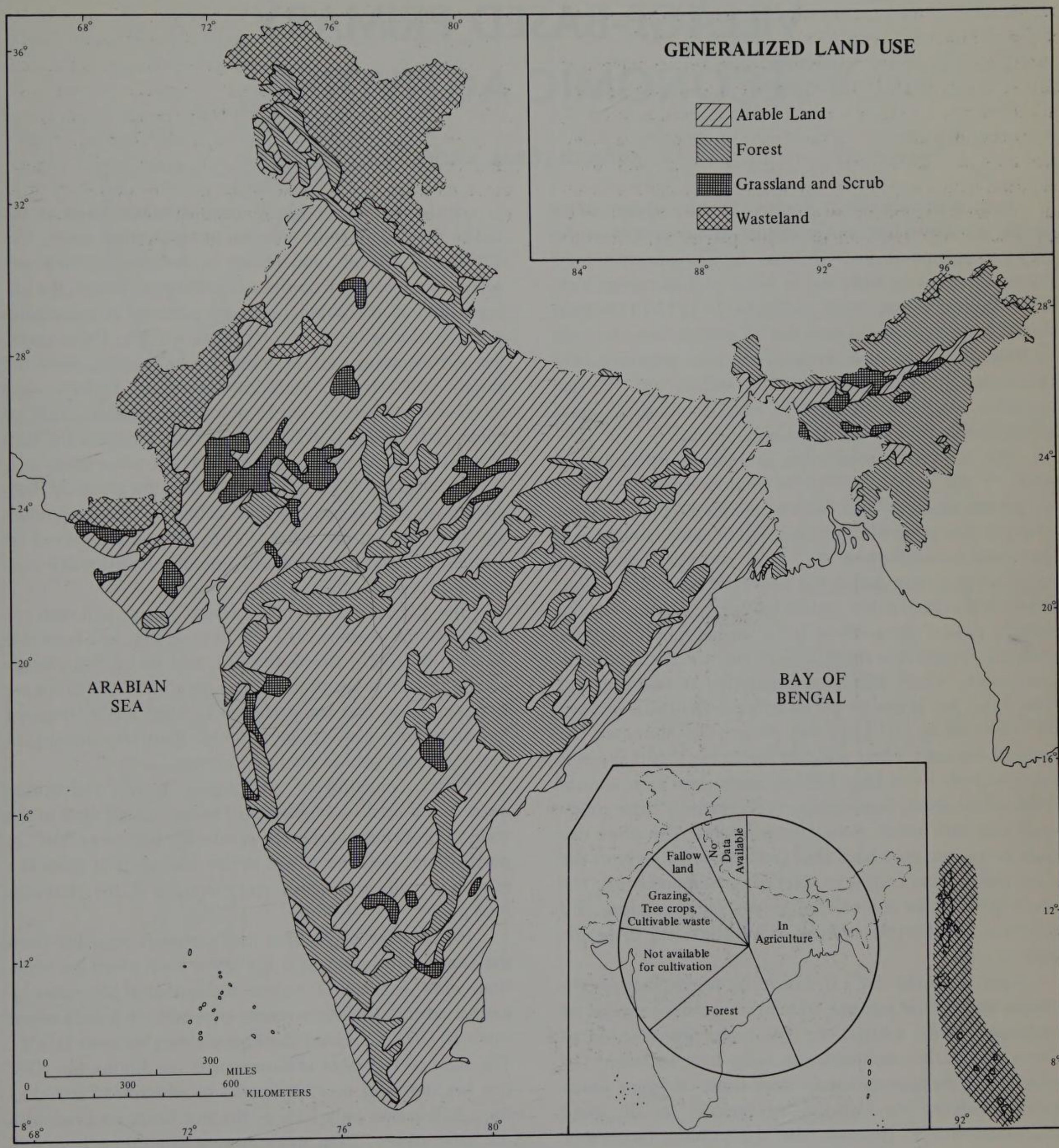
## LAND USES

Given the foregoing physical conditions, the people of India have used land suitable for agriculture, which has traditionally formed the principal means of livelihood. All of the plain lands, except Western Rajasthan which is a hot desert, and the comparatively level areas of the peninsular plateau are cultivated. The higher elevations, steep slopes, and mountain country are permanently snowclad, forested, or wasteland. Thus, the conventional feature of India's land uses may be characterized as level land plains, and lower elevation with adequate rainfall are generally under agriculture; whereas mountains, rugged plateaus and steep slopes, and areas of very low rainfall usually preclude the practice of agriculture.

As the population pressure accentuates increasing acreage of land is used for agriculture more than once a year (commonly referred as double-cropped or tripple-cropped land). A case study of one of the villages in South Bihar Plains is given below. Though in recent times efforts have been made to consolidate the scattered farmlands of individual farmers in Punjab and Haryana, agricultural land in India at the village level is typically fragmented into innumerable plots, which get further subdivided as inheritance takes place from one generation to the other. This creates uneconomic small land holdings. Whatever land is available for cultivation is used for cropping.




Source: N. Ali, *Masautha Khurd Landuse and Socioeconomic Survey*, Masters Village Survey, Department of Geography, Magadh University. (unpublished)


GENERALIZED LAND USE
Arable Land
Forest
Grassland and Scrub
Wasteland
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
Fallow land
No Data Available
Grazing, Tree crops, Cultivable waste
In Agriculture
Not available for cultivation
Forest

# Chapter 3

# VILLAGE-BASED PRIMARY ECONOMIC ACTIVITIES

## AGRICULTURAL CROPS

India is an agricultural country. Seventy percent of its people are dependent on agriculture, and over 40% of the national income is derived from it. The principal food grains produced in India are, in order of importance: rice, wheat, pulses, *jowar,* maize, and *bajra.* In 1972-73 the total Indian food-grain production was 95 million tons, although in 1970-71, a year when climatic conditions were especially favorable, production reached 108 million tons. Similar favorable conditions in 1974-75 have increased the grain production to an estimated 110 million tons.

The food-grain production in India is primarily the result of man's adjustment to the environment. Rice, which constitutes about 40% of India's food production, is grown wherever the physical conditions are favorable: alluvial soil, level land, rainfall above 45" (115 cm) per annum, and warm temperatures during the growing season. Such conditions are prevalent in the eastern half of India and along the western coastal plain. Wheat is the second most important crop and constitutes about 25% of the nation's food-grain production. Wheat also demands fertile, alluvial soil, and level land, but it can be grown in lesser rainfall areas, i.e., 25" (64 cm) to 50" (127 cm) per annum. Moreover, the contrast between wheat and rice lies in the fact that rice is more suitable to a high rainfall, warm monsoon climate while wheat grows better under comparatively drier conditions and with lower winter temperatures. The white rice grain is covered by a hard shell (kernel) which prevents the grain inside from rotting in spite of outside moisture. The wheat grain grows unprotected by any outer covering, and therefore any sizeable amount of moisture will cause the grain to rot.

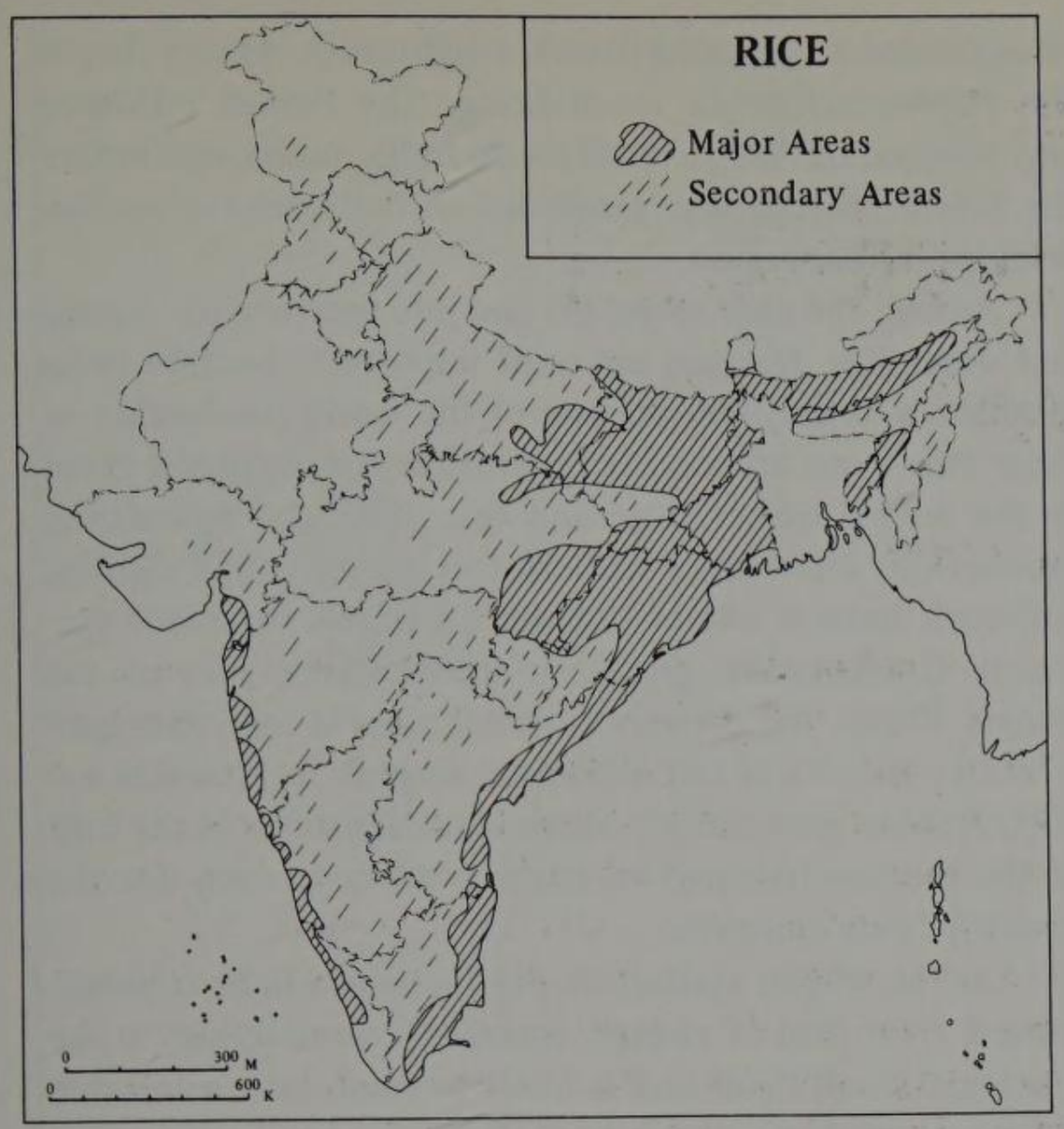
Approximately 84° E longitude forms the eastern margin and 25° N latitude forms the southern margin of traditional wheat cultivation. The recent introduction of Green Revolution techniques in India have increased the wheat yield by approximately three times on farms which have substituted the high-yielding varieties for the more traditional variety. However, the high-yielding varieties of wheat are now introduced outside the traditional growing area: in the northern plains of Bihar and the plains of western Bengal, Assam, and Orissa, as a dry winter-season second crop based on current levels of irrigation.

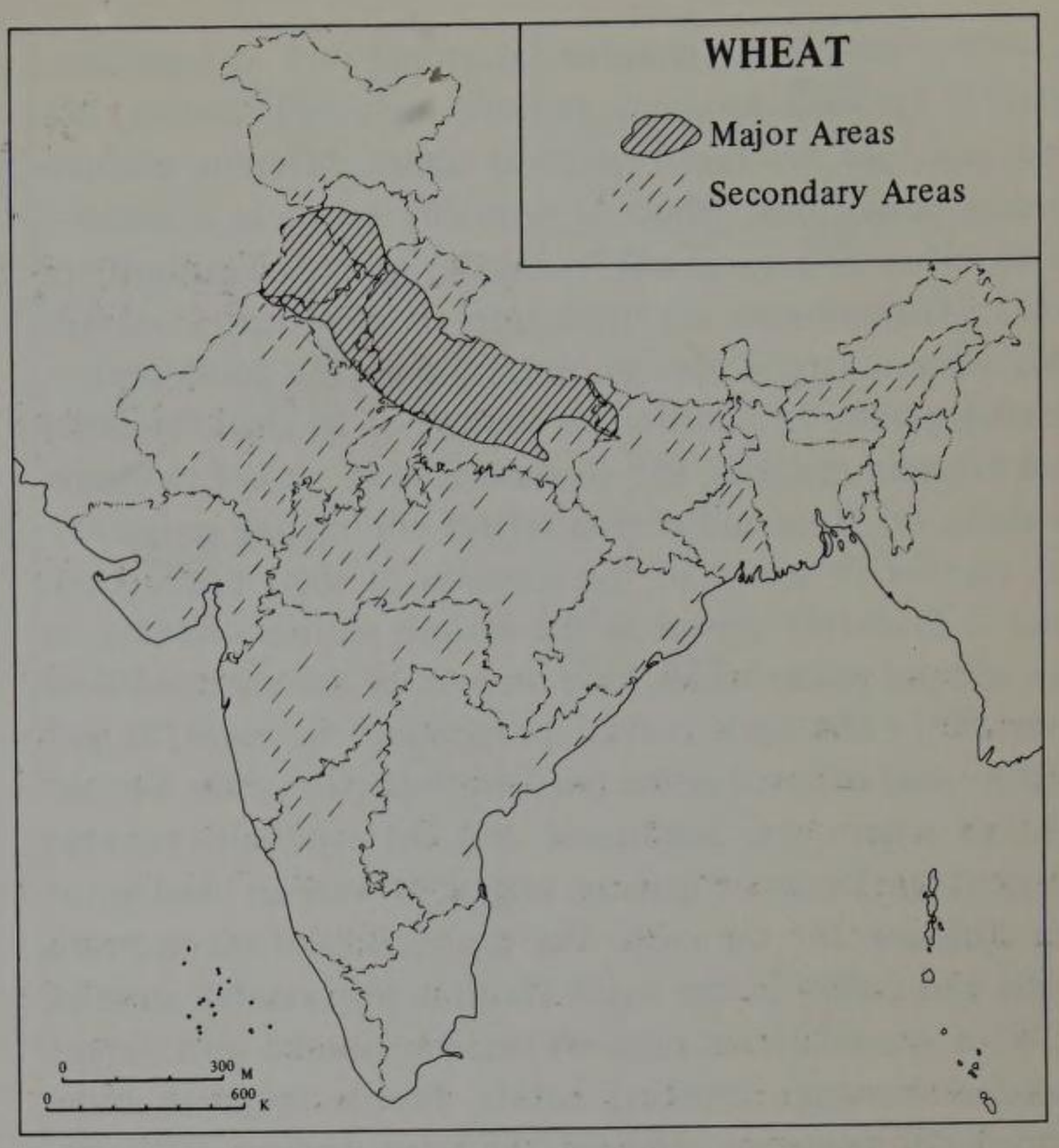
Although rice or wheat forms the main staple of the Indian diet, south India does not produce much wheat. Nor did Bengal, Assam, and Orissa in the east produce any wheat as a matter of traditional preference. Hence, the eating habits of the population have adjusted in accordance with the food-growing customs of the locality: for example, the northwestern part of India is bread-eating, while the eastern and southern parts are rice-eating. However, the increasing population needs more interregional trade of grain. Only wheat is available in surplus amounts for such trade. Rice is primarily consumed in the areas where it is grown because rice-producing plain areas are generally overpopulated. As a result, the food deficit of the rice-producing areas is met by wheat. Thus wheat-made bread or *chapaties* are being introduced into the traditionally rice-eating diets of eastern and southern India.

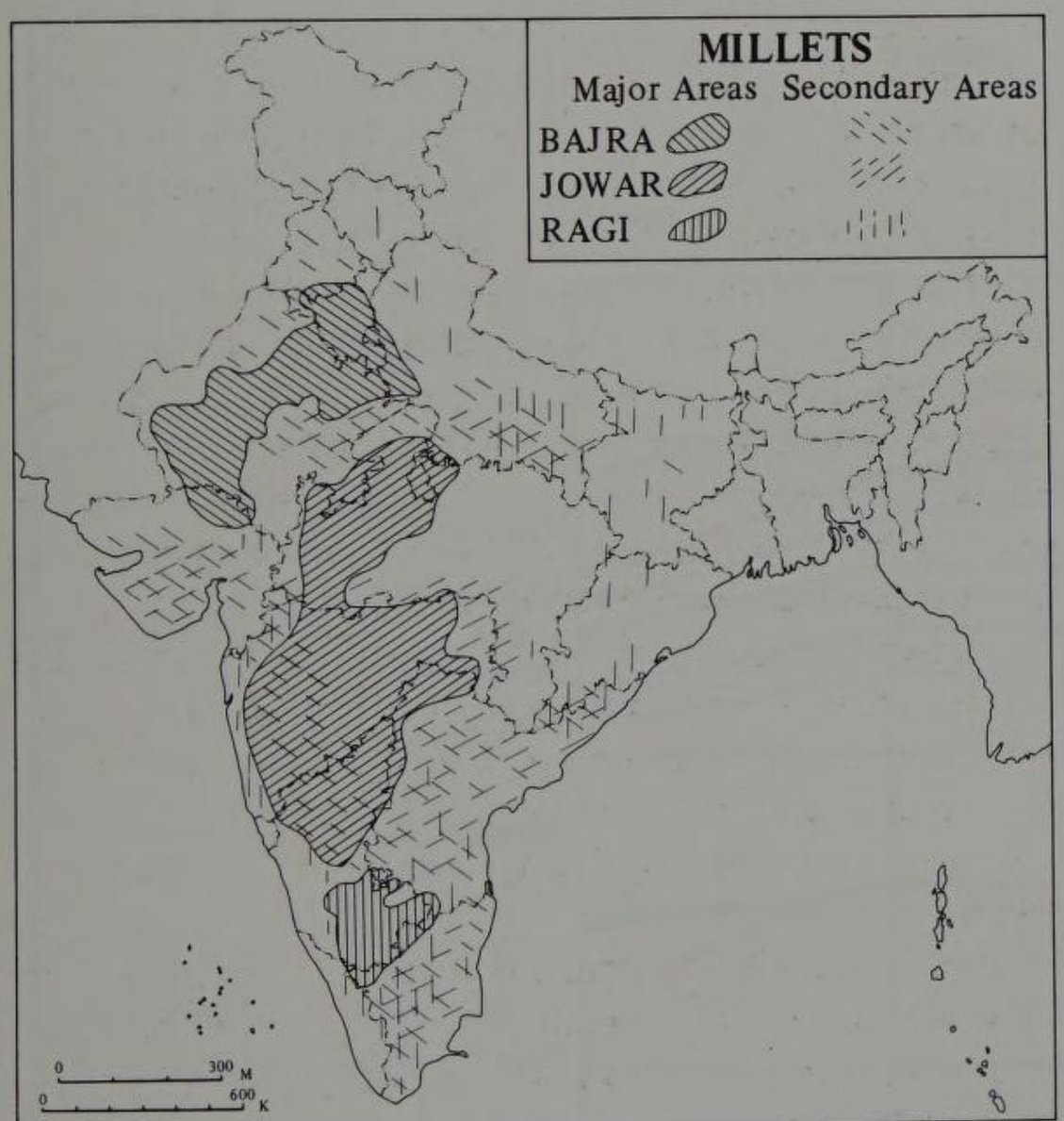
The three forms of millet (*bajra, jowar,* and *ragi*) are grown in the western half of India in the less favorable areas: hilly tracts, less fertile soil, and where the average annual rainfall is less than 25" (64 cm). These dry crops are less productive and less preferred as food; hence, they are known as poor man's food, although their nutritional content is actually greater than that of rice.

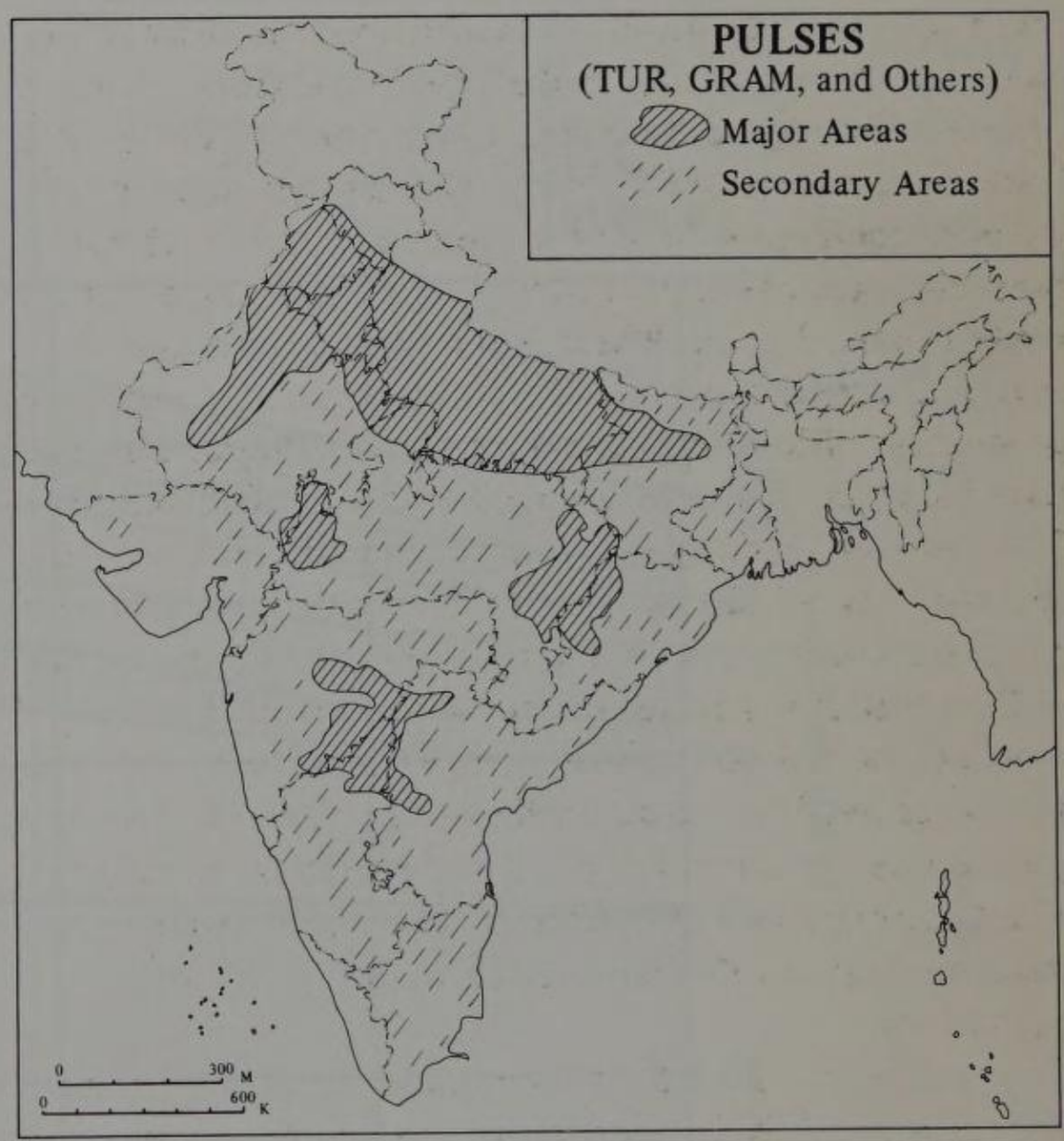
Pulses, consisting of peas, beans, lentils, and similar legumes are used to supplement rice and bread diets in the form of gravylike substances, commonly known as "dal" in north India. They are grown in the drier parts of India as a *rabi* crop with a principal concentration in the Northern Plains.

In the wake of modern improvements resulting from the Green Revolution, it is the wheat crop which has benefited most because of various technological and environmental advantages. As a result, over 60% of India's wheat sown in 1972-73 was of the high-yielding varieties (HYV). The lack of favorable environmental conditions for HYV rice has, up until now, prevented its widespread introduction. As a result, only 25% of the rice fields are sown with the new variety. Even more adverse conditions have prevented the further introduction of HYV in maize, *jowar,* and *bajra,* resulting in less than 10% of the area sown in these crops being of HYV.


RICE
Major Areas
Secondary Areas
0 300 M
0 600 K


WHEAT
Major Areas
Secondary Areas
0 300 M
0 600 K

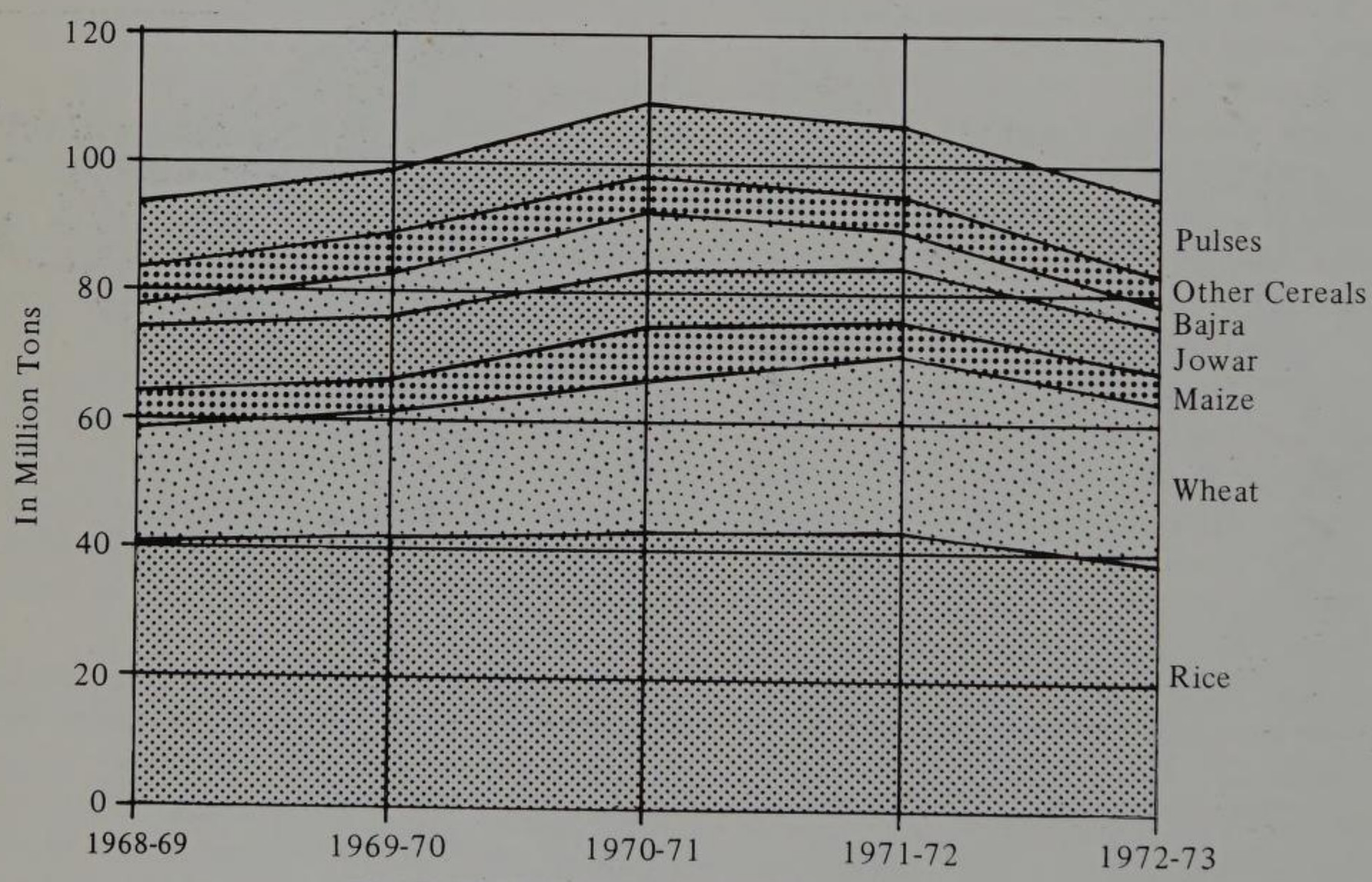

MILLETS
Major Areas Secondary Areas
BAJRA
JOWAR
RAGI
0 300 M
0 600 K


PULSES
(TUR, GRAM, and Others)
Major Areas
Secondary Areas
0 300 M
0 600 K

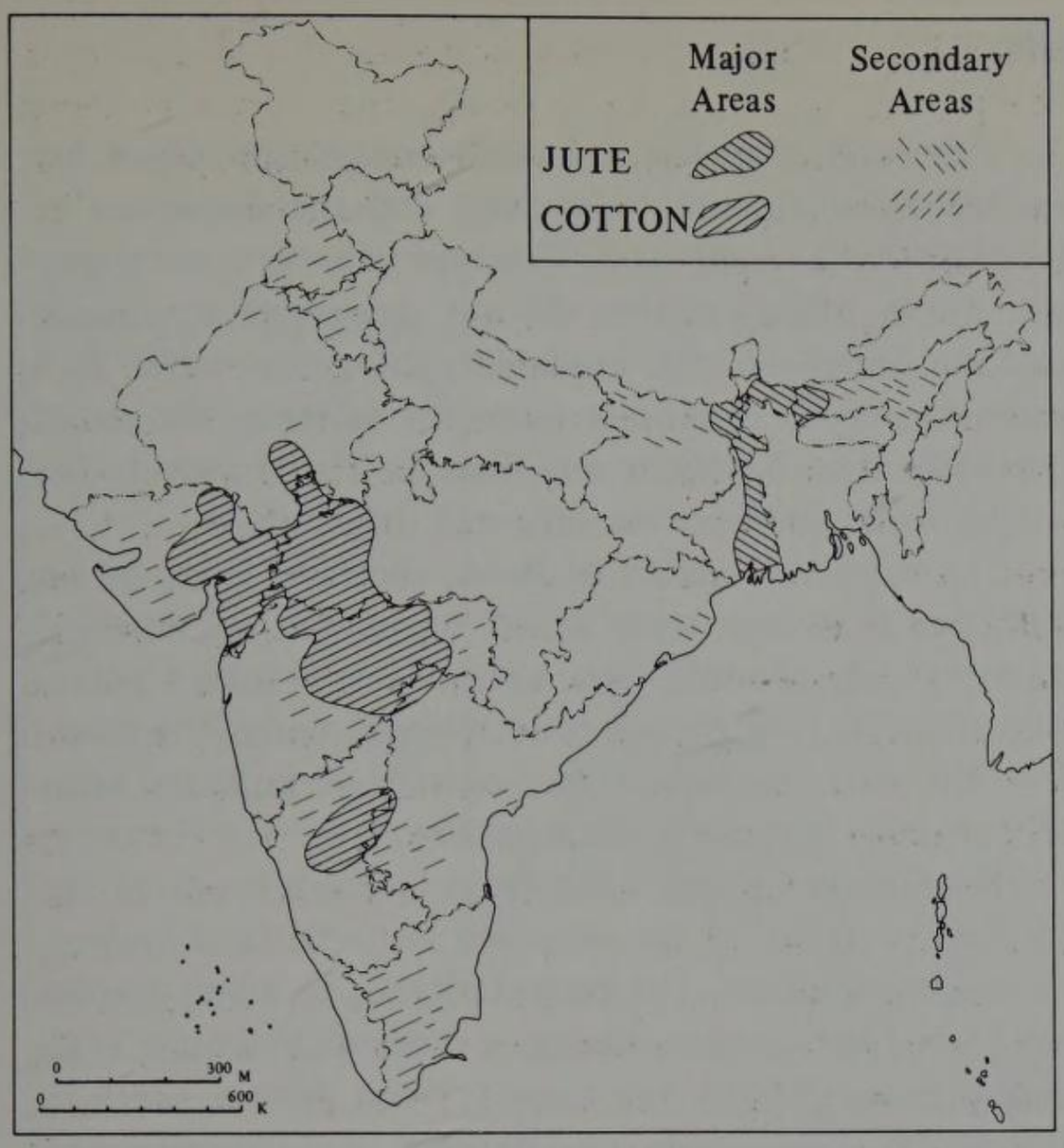
Cash crops (the commercial crops) such as sugarcane, oilseeds (ground nut and coconut inclusive), cotton, tea, and jute, are produced in India under different environmental conditions. Wheat is primarily grown in northwest India, whereas ground nuts (peanuts) are found in southern India. (Ground nuts are made into cooking oils.) Coconuts also have a large-scale concentration in the southwestern coastal plains. In addition to the use of its shell for ropes and housing material, the coconut fruit is pressed to obtain cooking oil. Jute and cotton reflect contrasting geographical regions in terms of the location of their production. Jute is favorably grown in the eastern section of India, in the *alluvial* plains which have an average annual rainfall of over 60″ (154 cm); cotton production, however, is primarily concentrated in the northwestern part of the Deccan Plateau where dry conditions and the especially suitable black (regur) soils of igneous origins provide an ideal growing situation for the crop. The production of tea in north India and coffee in the south (both in high-rainfall areas of hilly or mountainous regions) has contributed in different regional beverage drinking habits. People in north India principally drink tea, whereas, the south Indians drink coffee. Probably earlier British influence and their occupation of north India beginning from the eighteenth century, began the popularization of tea-drinking. The French influence and occupation of parts of south India during and before the nineteenth century, attributed to the spread of coffee-drinking in that region.

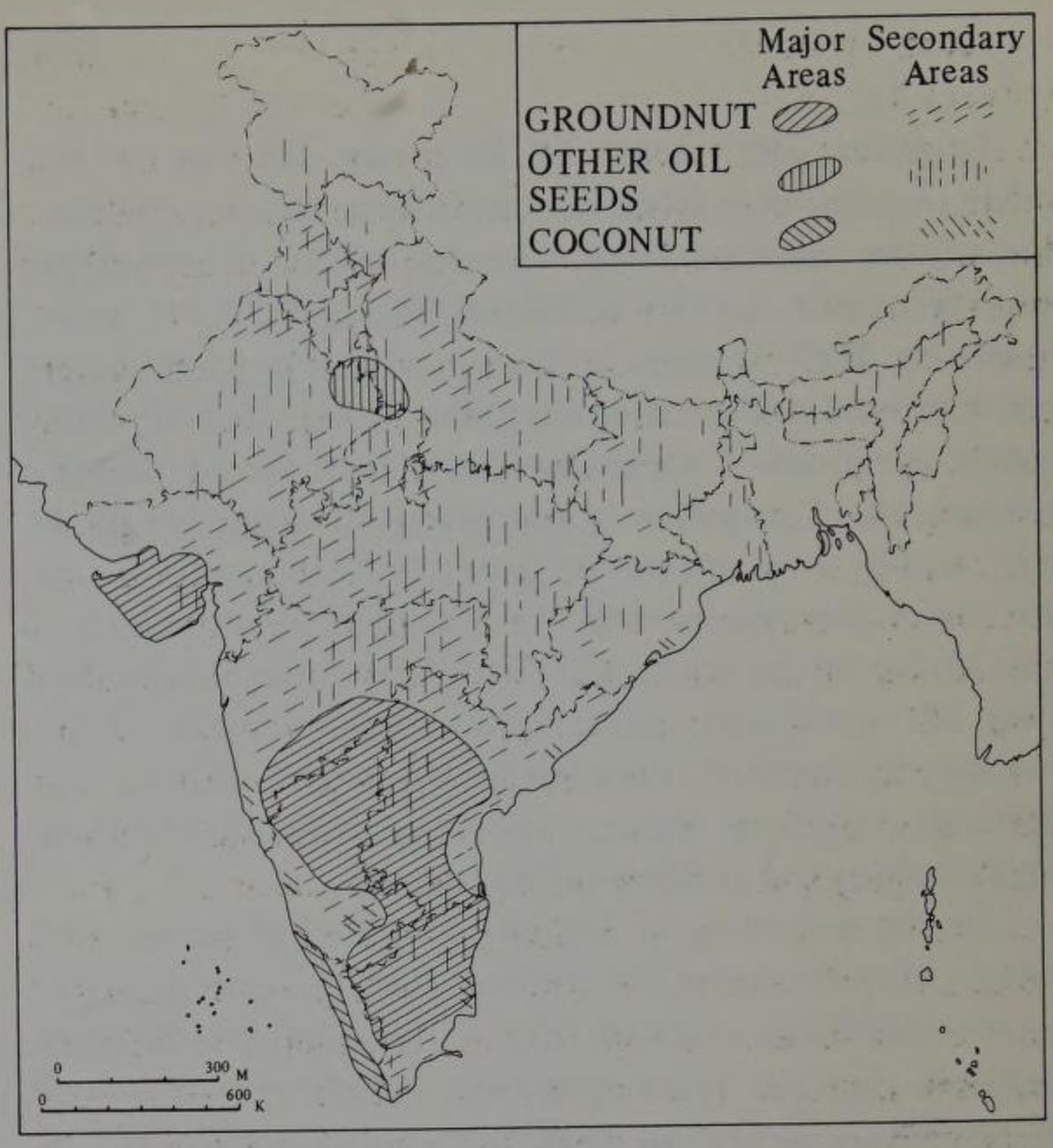
Among the cash crops, tea and jute (particularly burlap and other jute textiles) are most important, because India produces a sizeable proportion of the world production of these two items and also is responsible for supplying them to the world market. Jute and tea, of all the agricultural production, are India's highest foreign exchange earners. Although India is one of the world's largest sugarcane producers (traditionally grown in the northern part of the Ganges Plain), the country's overall yield is low, and until recently, there was not sufficient surplus for sizeable export. Rubber production, which is concentrated in the hills of the southeastern part of India, is adequate only for the country's own demands.

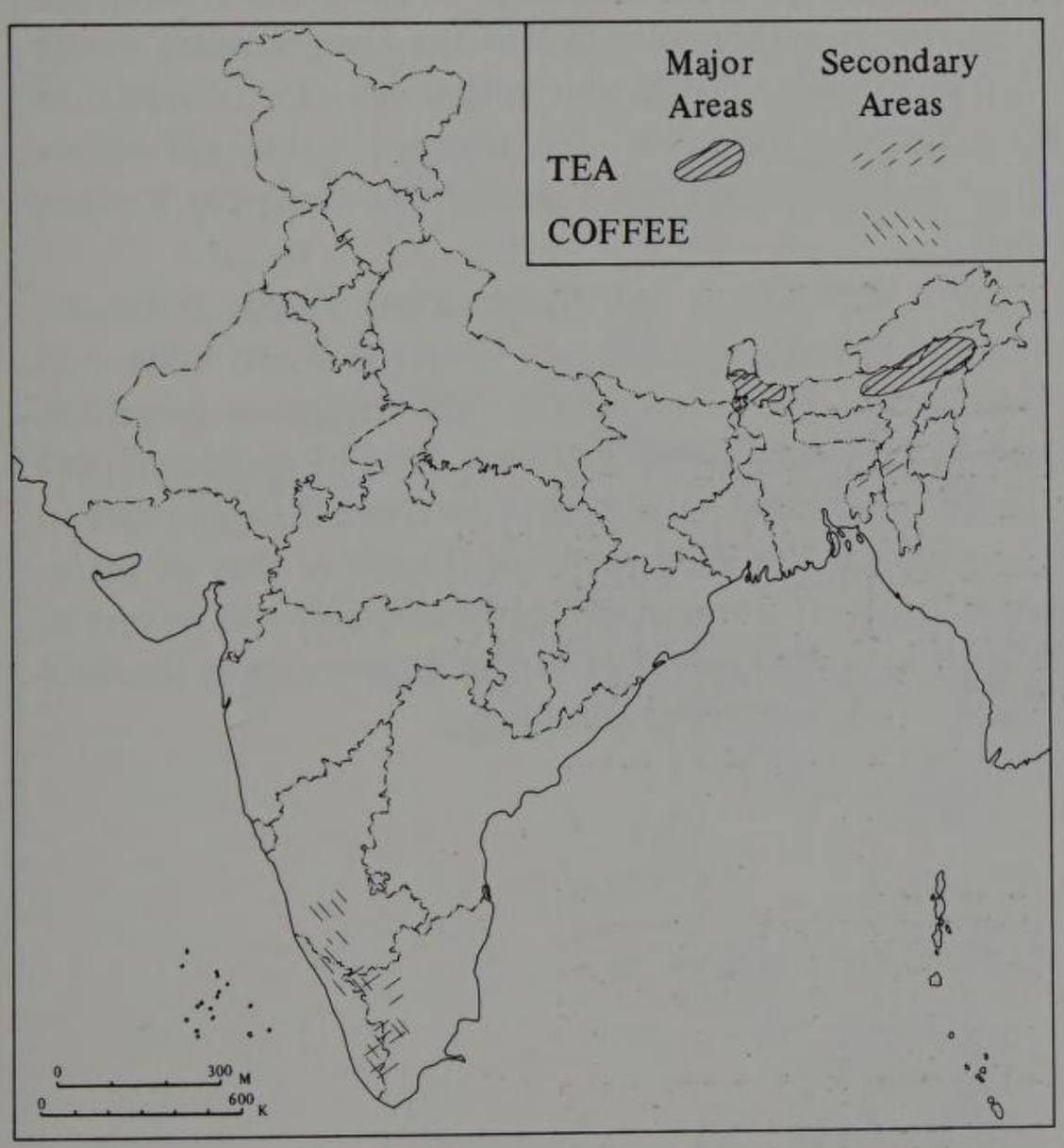
On the whole, agriculture production in India is undergoing a great deal of change. Increase in productivity is the main goal in all fields and is likely to result in considerable social, economic, contractual, legal, and infrastructural modernization in the future.

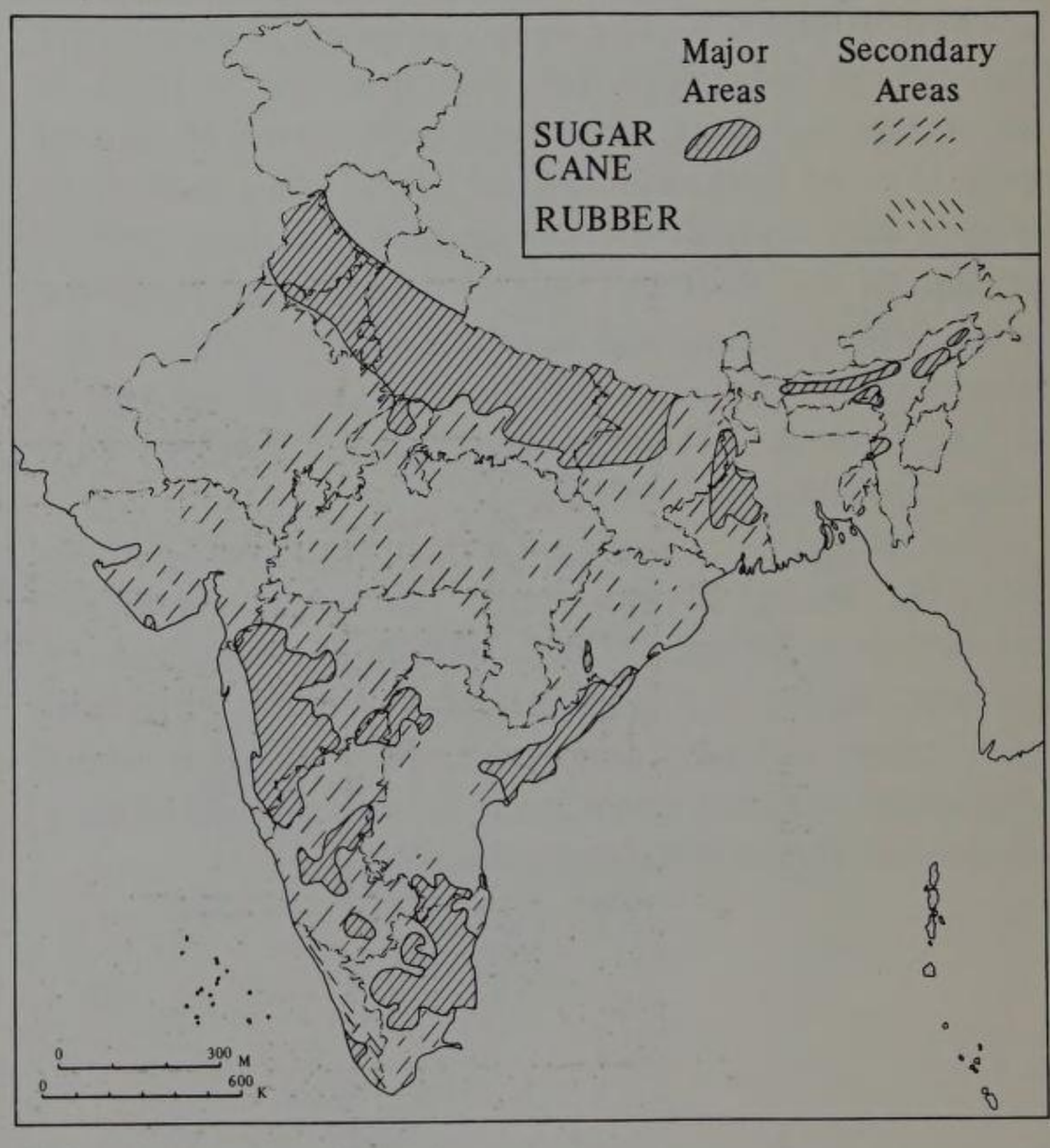



**RECENT FOODGRAIN PRODUCTION**


Major Areas
Secondary Areas
JUTE
COTTON
0 300 M
0 600 K


Major Areas
Secondary Areas
GROUNDNUT
OTHER OIL SEEDS
COCONUT
0 300 M
0 600 K


Major Areas
Secondary Areas
TEA
COFFEE
0 300 M
0 600 K


Major Areas
Secondary Areas
SUGAR CANE
RUBBER
0 300 M
0 600 K

## IRRIGATION

Irrigation may eventually determine the fate of the Indian population in terms of starvation or an adequate diet. One of the essential factors in the success of the high-yielding varieties (HYV) of seeds is the regulation of water. Therefore, HYV is more fruitful in the areas where irrigation is utilized. Indian rains are primarily seasonal; the rainy season, therefore, is more productive than the dry season, in areas where irrigation is not practiced. Irrigation, however, cannot only enable dry areas to be farmed but can also make the regions which are dependent on monsoon rains arable in the dry season. Thus, the increase in productivity of agricultural crops is very closely aligned to the practice of irrigation. Since irrigation assures an area of a sufficient supply of water, it is particularly important to the drought-prone sections of the country.

By the beginning of the 1970s, India had almost 142 million hectares under cultivation, of which three-quarters can be ultimately irrigated from surface and groundwater resources. Surface water irrigation consists of canals and tanks, while groundwater irrigation is obtained by tube-well pumps or traditional wells.

Canal irrigation is more widely practiced in areas where water can be obtained either directly from the rivers or from storage reservoirs. Since canal water flows by natural gravity it is the level plain regions which profit most from this kind of irrigation. Canal irrigation, therefore, is most prevalent in the Northern and Eastern Plains, along the Eastern Coastal Plains, and along the narrow valleys of the Deccan Rivers. The recent efforts to irrigate the margins of the Rajasthan desert compares well with southern Californian canal irrigation systems.

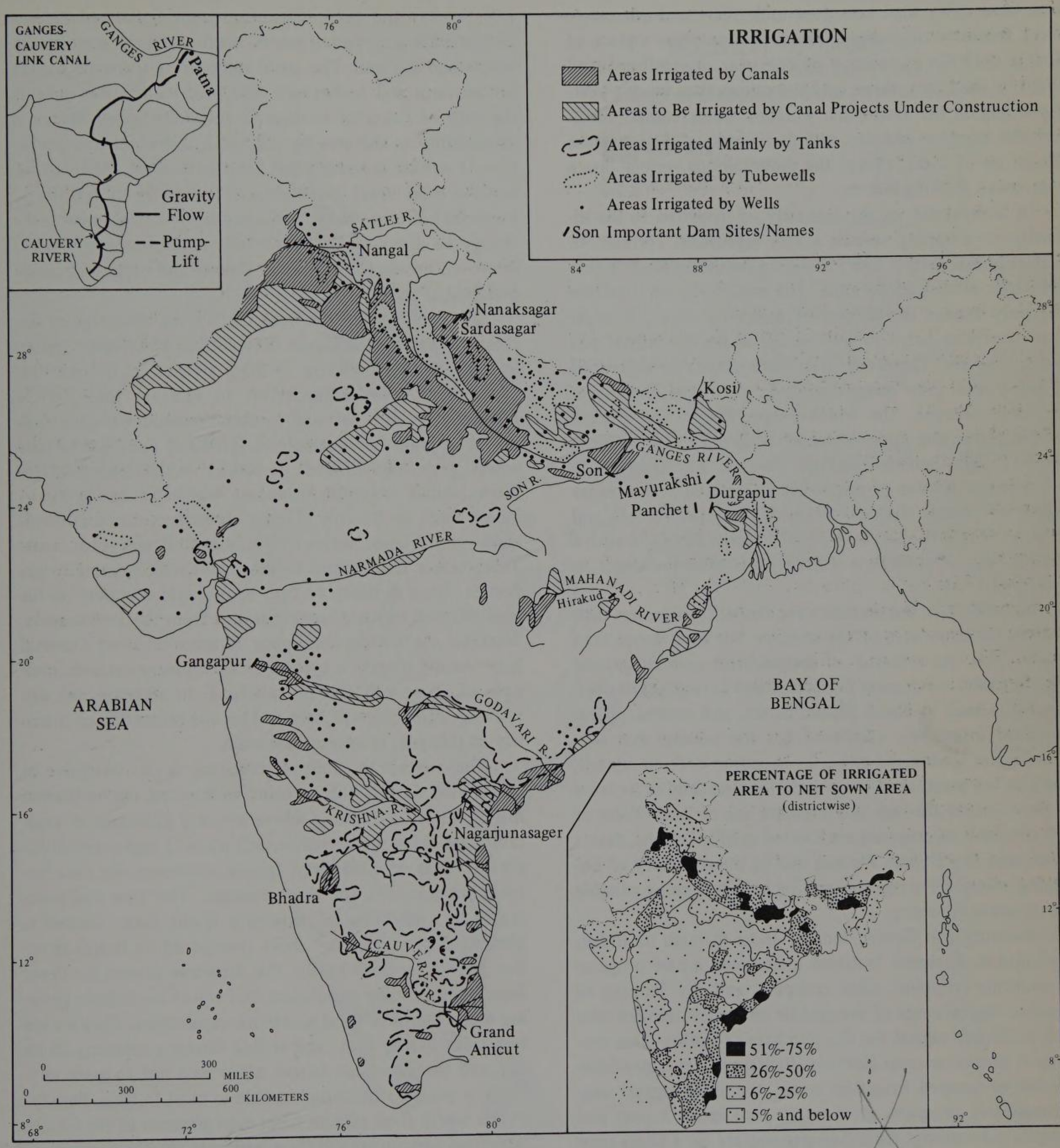
Tank irrigation is prevalent primarily in the southern part of the Deccan Plateau. Tanks cover small catchment areas per unit, whereas a canal may cover thousands of acres in its supply area. Tank irrigation requires a hilly surface to create natural storage areas. Rains that fall during the monsoon season are stored in the reservoirs to be used during times when rainwater is not available.

Tube-well irrigation is a recent innovation which has resulted from modern technology and the dispersion of electricity in the rural areas. This type of irrigation is prevalent where subsoil regions do not encounter any rocky surfaces. Moreover, the availability of groundwater at a reasonable depth is another necessary factor in the use of tube-wells. The Northern and Eastern Plains provide the best physical conditions for tube-well irrigation.

The irrigation system of India, therefore, is based on utilization of various types which are suitable for different conditions. By the mid '70s, about 40% of India's potentially irrigable acreage had been brought under irrigation. Most likely by the turn of the century all potential areas will have been brought under irrigation.

The Ganges-Cauvery Link Project, which is one of the principal proposals of the proposed National Grid System, is a unique endeavor. The Project intends to divert surplus water from the Ganges through a series of hydraulic engineering techniques to the Cauvery, and further south, a distance of 2,200 miles (3,520 km). A barrage on the Ganges near Patna is the first stage of this project; from this barrage 10-20 million acre feet of the Ganges water would be lifted to about 2,000 feet within the short distance of 200 miles and thereafter, the diverted water will follow natural gravity except for a short route along the Krishna River.

Thus, the Son in the South Bihar Plains, Narmada, Godavari, Krishna, and Cauvery Rivers in south India, will get adequate water to improve their irrigation potential, which in turn will enable 3 million acres of additional land to be irrigated. The project will take more than 25 years to be completed, but the crucial constraint is that of astronomical costs. If the project comes true this will be one of the greatest achievements of Indian engineering in the field of the modern hydraulic technology.


GANGES-CAUVERY LINK CANAL
GANGES RIVER
Patna
CAUVERY RIVER
Gravity Flow
Pump-Lift
IRRIGATION
Areas Irrigated by Canals
Areas to Be Irrigated by Canal Projects Under Construction
Areas Irrigated Mainly by Tanks
Areas Irrigated by Tubewells
Areas Irrigated by Wells
Son Important Dam Sites/Names
SATLEJ R.
Nangal
Nanaksagar
Sardasagar
Kosi
GANGES RIVER
Son
SON R.
Mayurakshi
Durgapur
Panchet
NARMADA RIVER
MAHANADI RIVER
Hirakud
Gangapur
ARABIAN SEA
BAY OF BENGAL
GODAVARI R.
KRISHNA R.
Nagarjunasager
Bhadra
CAUVERY R.
Grand Anicut
PERCENTAGE OF IRRIGATED AREA TO NET SOWN AREA
(districtwise)
51%-75%
26%-50%
6%-25%
5% and below
0 300 MILES
0 300 600 KILOMETERS
68° 72° 76° 80° 84° 88° 92° 96°
8° 12° 16° 20° 24° 28°

## INTENSITY OF CROPPING

The only means by which India can feed its people is by increasing the yield of its crops and by cultivating the same land more than one time each year (multiple cropping). Intensity of cropping refers to how often a piece of land is used for cultivation in one year. Agricultural land could be used two, three, and sometimes four times a year, depending on the availability of labor, water, capital, fertilizer, the selection of crops, and their marketability, because almost all of India, except the mountainous regions, has a year-round growing season.

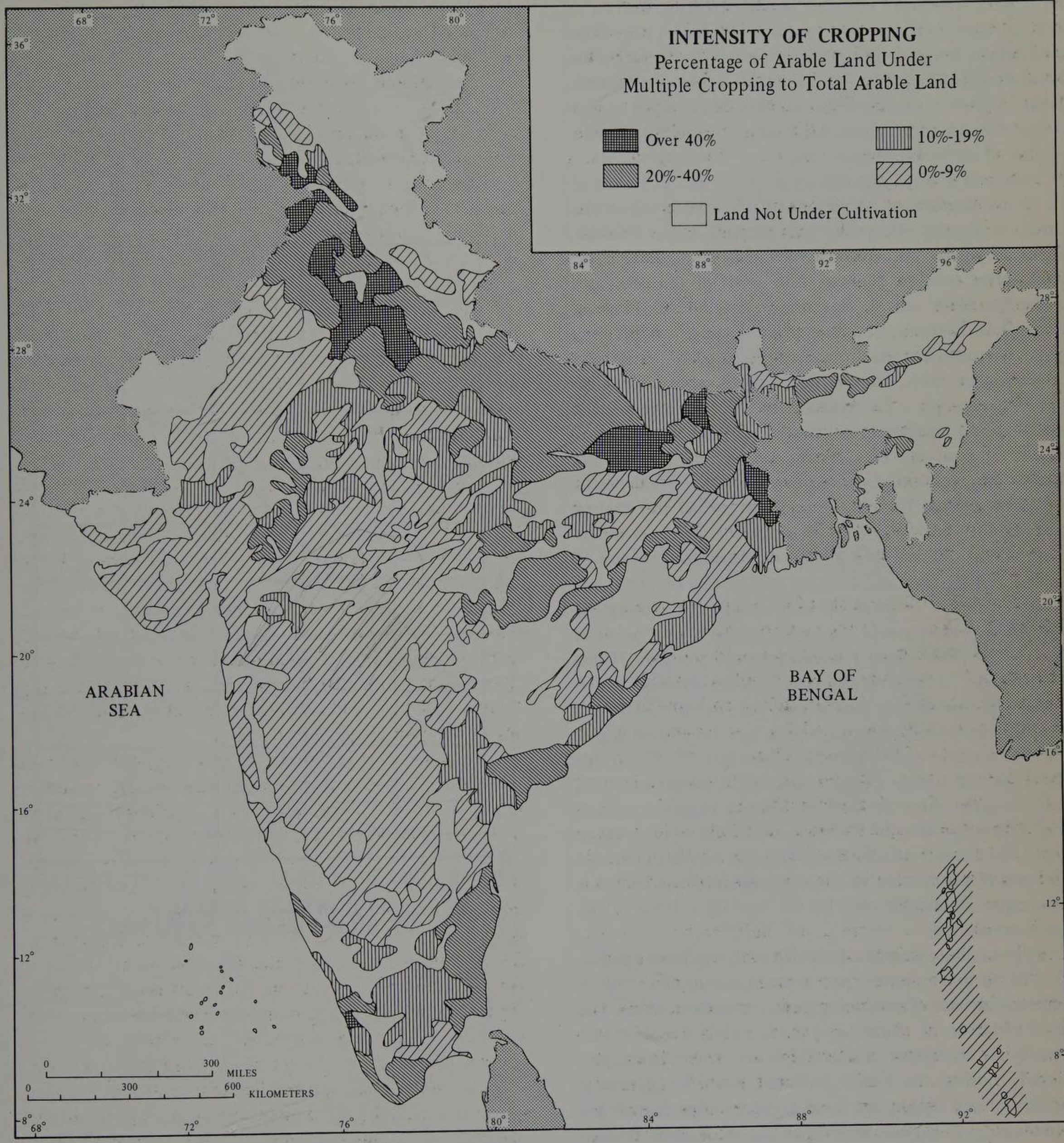
A comparison of the intensity of irrigation to the intensity of cropping reveals a very significant correlation. Generally one crop a year, based on monsoon rains, is possible over almost all of India. The availability of irrigation not only assures the success of that crop during drought years, but also helps to grow crops in the dry winter and spring seasons. Therefore, it is understandable that most irrigated areas grow more than one crop a year. Such areas are, for example, the Indus-Ganges Plains, the eastern coastal plains, the upper Mahanadi Valley, and the irrigated areas of Rajasthan and Madhya Pradesh. Furthermore, in the southern portion of the western coast, the Brahmaputra Valley of Assam, the hilly areas of Himachal Pradesh and Kashmir where the annual rainfall exceeds 70″ (178 cm), a second, and sometimes a third crop is grown without irrigation.

According to the statistics for the late 1960s, less than 20% of the sown area of the country was sown more than once a year. As a matter of geographical correlation, the regions which are densely populated and have physical characteristics such as flood plains, deltas, and coastal plains, are most intensively cultivated for the reasons that adequate water is obtained either by irrigation or from rainfall, and also the pressure of the population demands an increase in farm output through the intensive use of land. Areas of low intensity of cropping are located in hilly regions, desert areas, and the Deccan Plateau due to the difficulty of obtaining water for irrigation and/or soils not being suitable for intensive cropping.

Recently the Government of India through its Indian Agricultural Research Institute introduced a new program of multiple cropping, relay cropping, and dry farming to increase the earnings of the middle and small farmers who lack sufficient capital for the purchase of inputs. This program is known as crop cafeteria. In areas where dependable rainfall or assured irrigation occur, the small farmer can, through this program, grow up to four crops a year and increase his earnings from $40 per hectare on a single crop basis to $130 per hectare on a multiple crop basis. In fact, the farmers of Bihar, near the city of Patna, have been utilizing this technique for a long time, relying on monsoon rains and traditional well irrigation. They raise wheat, potatoes, sugarcane, mustard, and vegetables, in combination with poultry and cattle. The crops are well planned and are alternated in a system of relays, maximizing the use of both inputs and the land. The cattle and poultry thrive on wastes of the farm and homestead. The produce is either sold in the city of Patna or is shipped elsewhere, given the easy accessibility in the area by rail, road, and water transportation. A similar technique has been devised by the Institute for the drier areas employing efficient use of fertilizers, bacterial cultures, water management practices, new technology of direct-seeded rice which minimizes crop losses, improved means to counteract disease and pests, and cross-breeding of cattle.

The wealthy farmers have taken great advantage of the recently developed Green Revolution techniques. After learning the profitability of farm output in the marketplace, they make every effort to increase their farm's productivity, and the most common technique used is multiple cropping. For example, a farmer in Punjab produces wheat, gram, and oilseeds or fodder in the same field because he has expendable income which he can invest in inputs such as tractors, fodder threshers, chemical fertilizers, hybrid seeds, water pumps, diesel oil, and labor costs. Therefore, a rich farmer in the plains with existing irrigation facilities is likely to turn to multiple cropping on his own without much direct assistance from the government. Whereas, the middle and poor farmers do need external help. As the irrigation system of the country extends, multiple cropping will also be extended. In addition, the dry farming technique will help further the utilization of intensity of cropping in appropriate areas.

The concept of multiple cropping is not unknown in the United States, but its most widespread use is limited mainly to truck farming where as many plantings of vegetables are made as the season will allow. Large-scale multiple plantings of field crops (grains, soybeans, etc.) are virtually nonexistent for three reasons. The first and main reason is availability of extensive arable land. Second is climatic limitations; the short (compared to India) frost-free growing season. Lastly, the American farmer has never faced a burgeoning population that would necessitate growing every ounce of food within his capabilities. Thus we see two sides of the coin: the Indian farmer producing all he can and the American farmer often paid not to grow anything, a practice incomprehensible to most Indians. Perhaps as the world food picture turns even grimmer in the future, American agriculture will force itself into greater production. Then multiple cropping may enter the American scene, always limited, however, by climatic considerations.

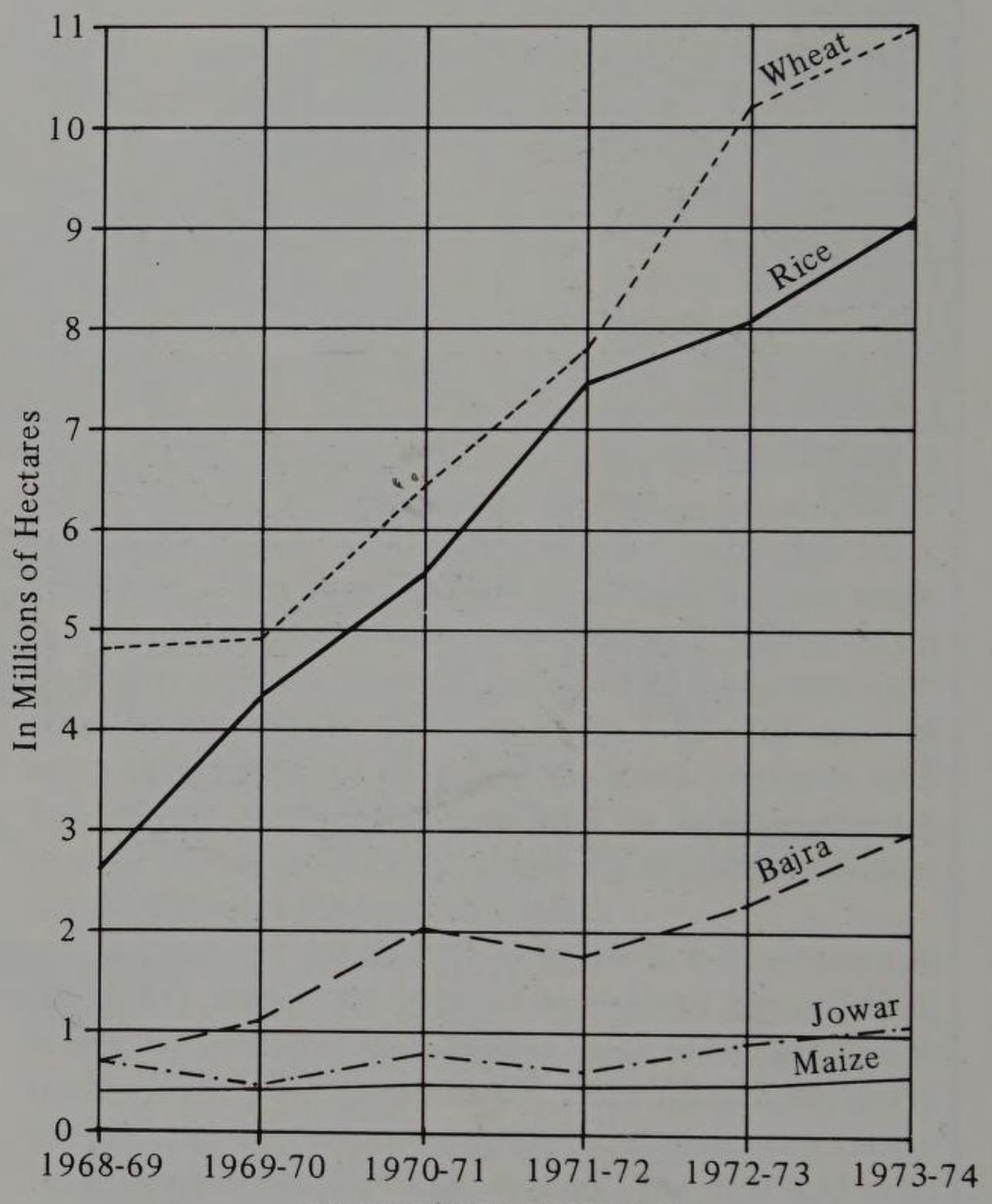

INTENSITY OF CROPPING
Percentage of Arable Land Under Multiple Cropping to Total Arable Land
Over 40%
20%-40%
10%-19%
0%-9%
Land Not Under Cultivation
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

## GREEN REVOLUTION

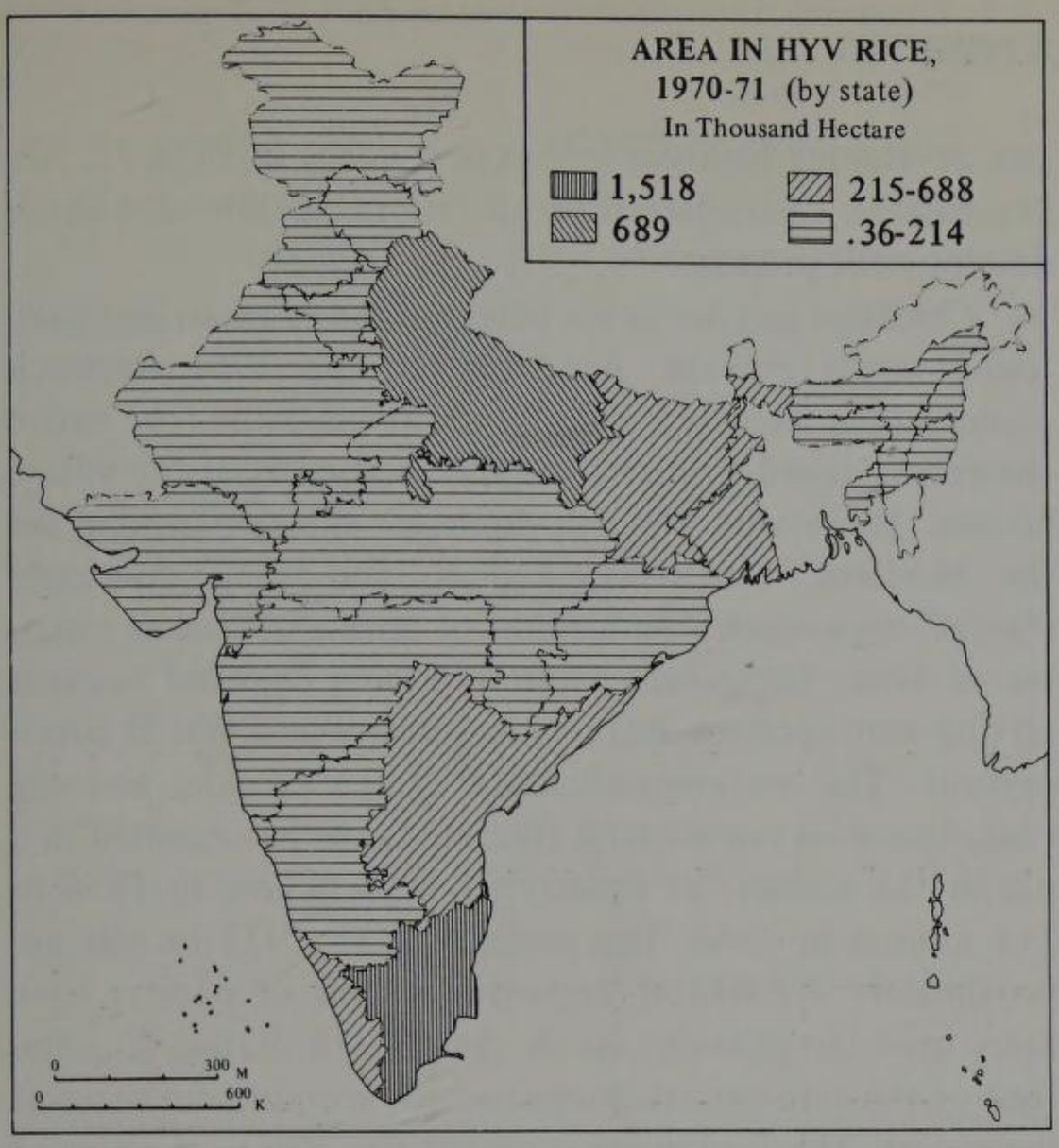
The Green Revolution in India was initiated in 1966 when high-yielding varieties (HYV) of wheat and rice were introduced. The basic research for HYV wheat, known as Mexican Dwarf variety, was conducted by Nobel Prize Winner Norman Borlaug. The HYV rice was introduced by the International Rice Research Institute in the Philippines. Indian scientists modified the primary HYV types to suit Indian climatic and topographic conditions and developed a number of native varieties as well.

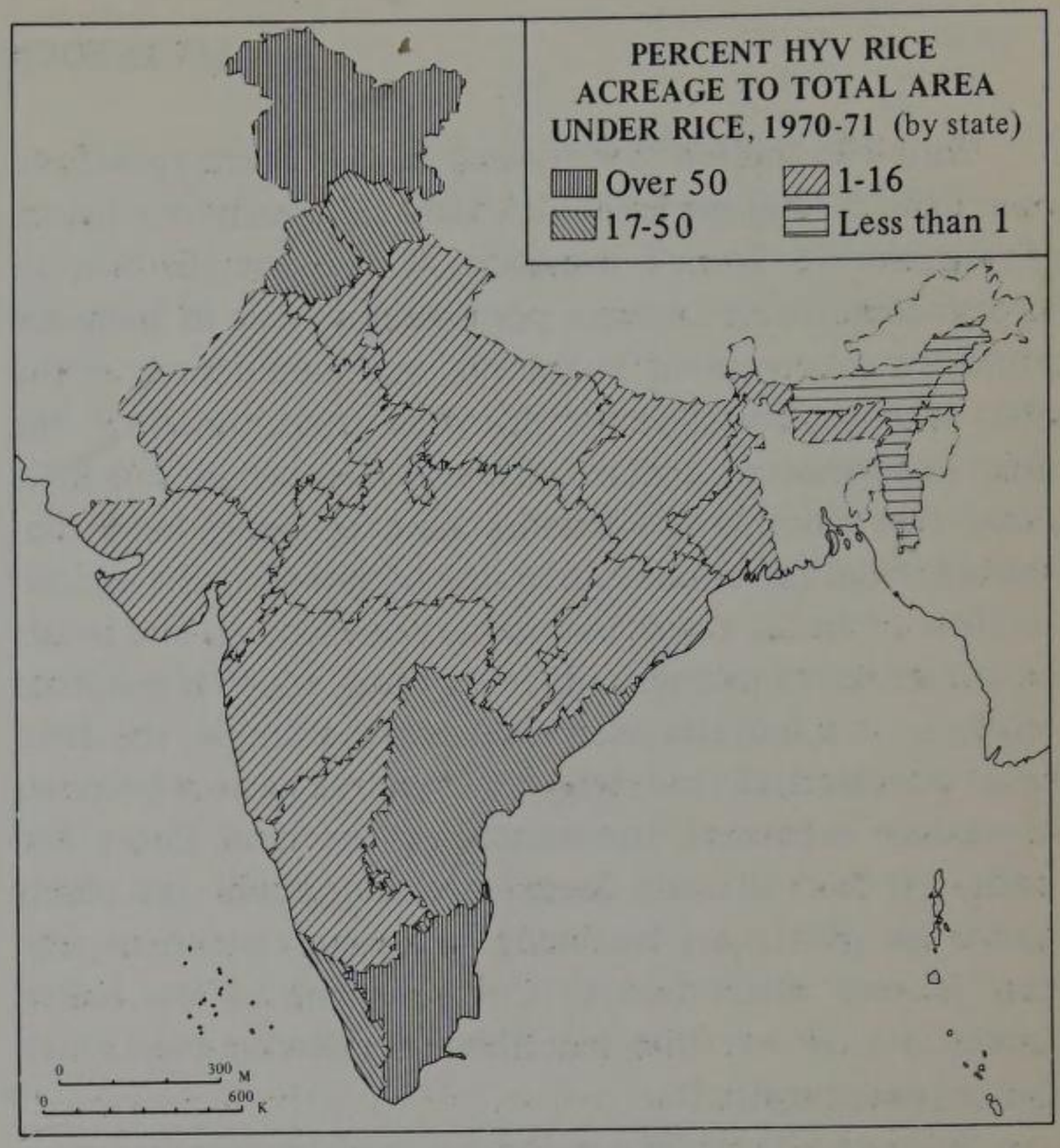
There is a wide regional variation in the diffusion of the Green Revolution techniques. In the case of wheat, the states of Punjab, Haryana, and western Uttar Pradesh, where irrigation is a certainty, have benefited most. These three states account for over two-thirds of the country's acreage in HYV wheat. Regarding rice, Andhra Pradesh, Jammu and Kashmir, Tamilnadu, and Kerala have profited most. The initial center for the diffusion of HYV rice was Tamilnadu in 1966. Wherever HYV rice is successful, irrigation is necessarily a concomitant factor. The high rainfall areas of West Bengal, Bihar, Assam, and Orissa, which experience a great deal of daily and seasonal variation in the amount of precipitation, have not adopted the HYV rice to any great degree. This is due primarily to the fact that in high rainfall areas water control during the monsoon season is extremely difficult and a more sophisticated system of controlled irrigation and drainage is necessary for HYV rice compared to HYV wheat. As a compensation, during the dry winter season a *rabi* crop (dry season winter crop) in the form of HYV wheat is becoming more prevalent. Thus, West Bengal, Assam, Orissa, and Andhra Pradesh which formerly produced very little wheat, have begun to devote a sizeable area of *rabi* crop to wheat. In West Bengal alone, 320,000 hectares were planted in wheat in 1970-71. Of this figure, almost ninety percent was HYV wheat. In 1975, West Bengal's wheat production reached almost a million tons. The proportion of HYV wheat to total wheat areas in Assam, Orissa, and Andhra Pradesh is also very high because most wheat production in these states and West Bengal is new, made practicable only by the new HYV seeds of the "green revolution."

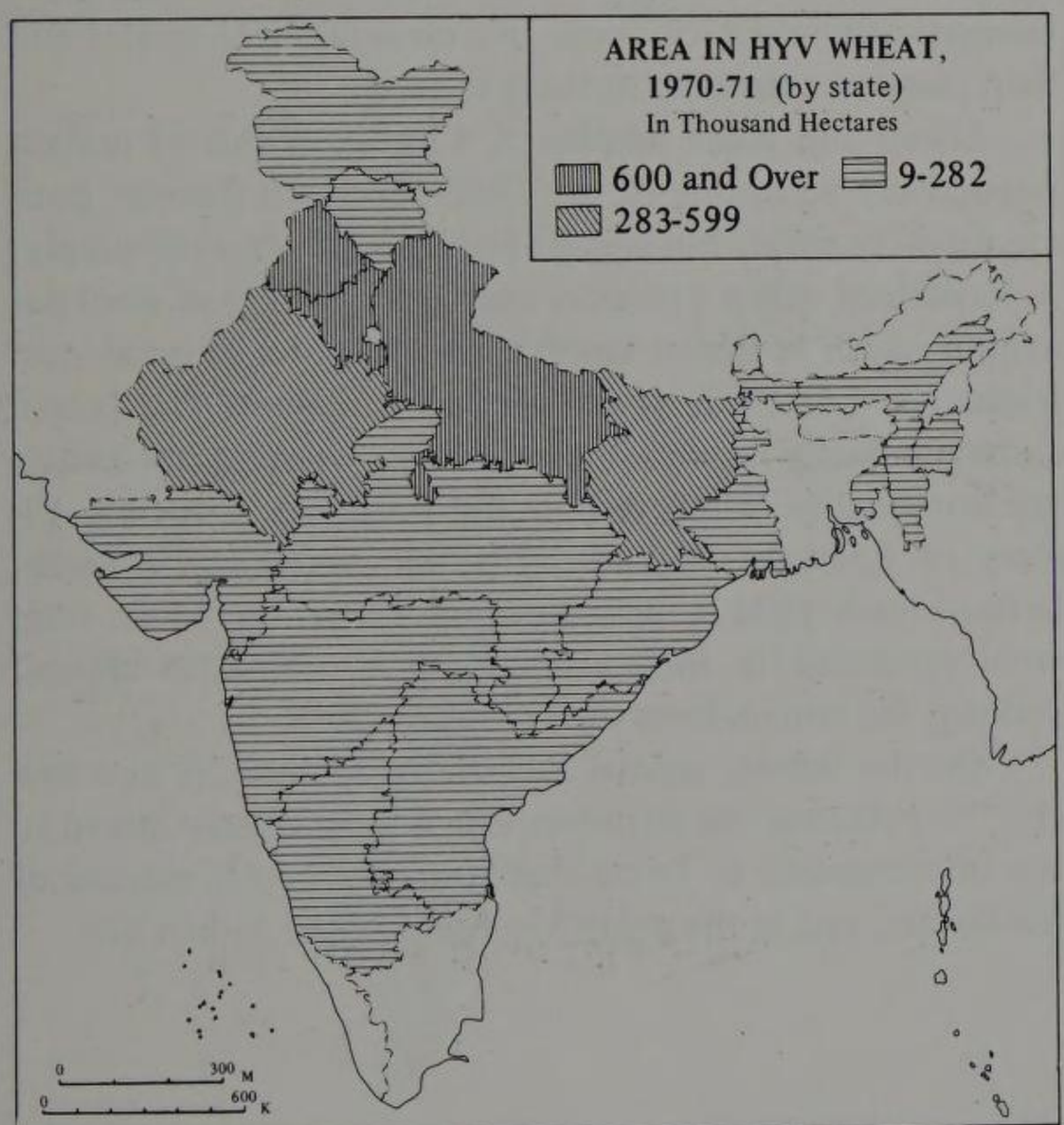
High-yielding varieties, provided with regulated applications of fertilizer, water, pest control techniques, and so forth, are capable of producing greatly increased yields. The wheat yield can be tripled, and the rice yield doubled. This capacity for increasing production is very encouraging, particularly viewing the future problems posed by increasing population and inadequate food supply. Indian farmers are hardworking. Moreover, there is no dearth of labor. If management, organization, and the required inputs in the form of HYV seeds, an adequate supply of water and fertilizers (both chemical and organic) are utilized efficiently, there is reason to believe that one day India will again be capable of feeding herself.

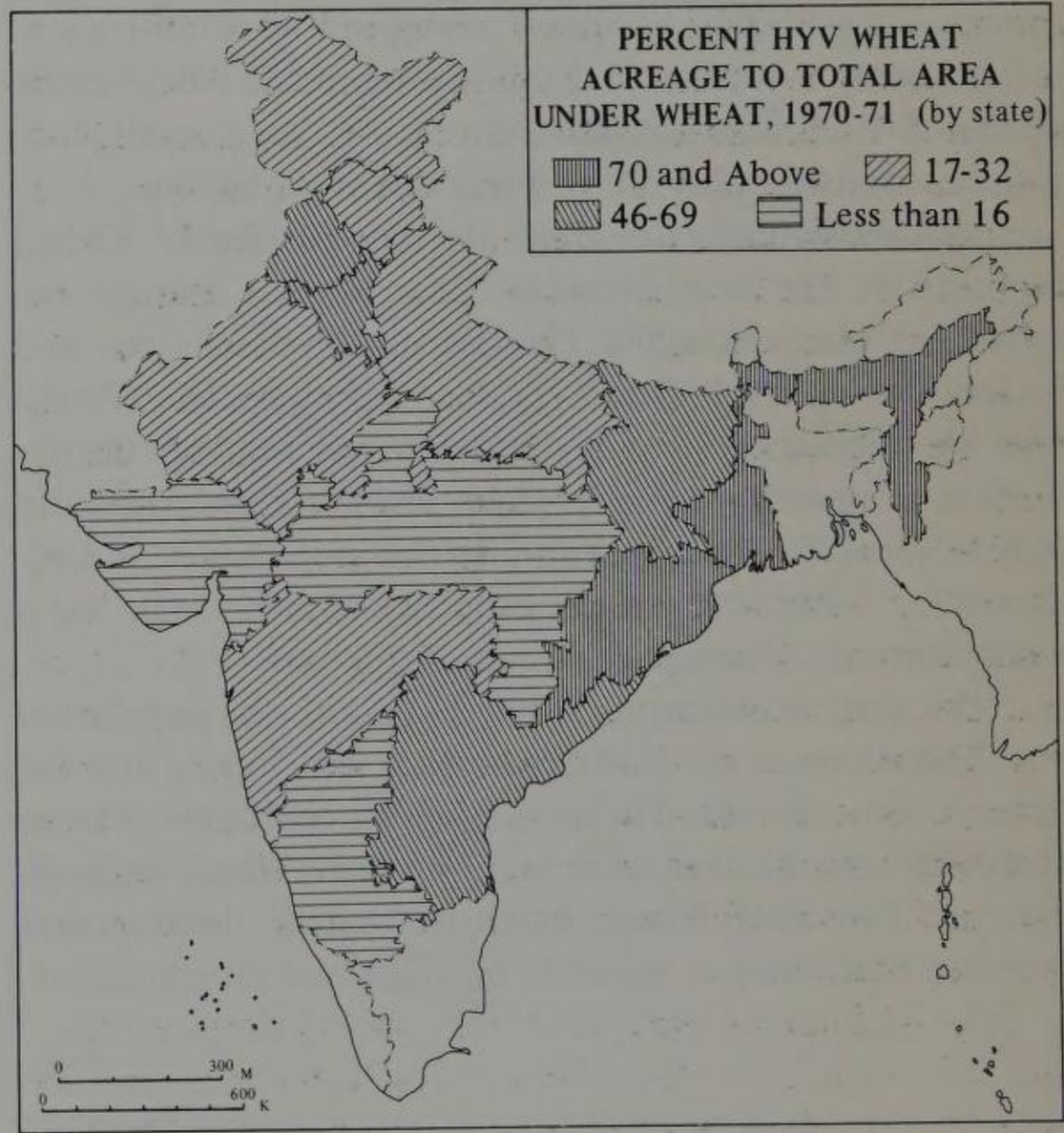



**GROWTH IN ACREAGE OF HIGH YIELDING VARIETIES**


AREA IN HYV RICE,
1970-71 (by state)
In Thousand Hectare
1,518
689
215-688
.36-214
0 300 M
0 600 K


PERCENT HYV RICE
ACREAGE TO TOTAL AREA
UNDER RICE, 1970-71 (by state)
Over 50
17-50
1-16
Less than 1
0 300 M
0 600 K


AREA IN HYV WHEAT,
1970-71 (by state)
In Thousand Hectares
600 and Over
283-599
9-282
0 300 M
0 600 K


PERCENT HYV WHEAT
ACREAGE TO TOTAL AREA
UNDER WHEAT, 1970-71 (by state)
70 and Above
46-69
17-32
Less than 16
0 300 M
0 600 K

## LIVESTOCK AND POULTRY

With 176 million (1966 data) head of cattle (cows and oxen) and 52 million buffaloes, India has nearly one-fourth of the world's horned livestock. It also has the world's largest domesticated bovine population. Cattle in India are primarily concentrated in the hot and humid areas of the east, whereas buffaloes are primarily concentrated in the drier northwestern regions. The cow is a sacred, but little cared for, animal. The bovines have probably been considered, from time immemorial, the lifegivers by the agriculturalists of India. Oxen are used as plow animals and beasts of burden; cows provide milk. Cow dung, which is collected regularly, is a multiple-use product: for example, the dried cakes provide fuel, and, when made into a paste it becomes a waxlike substance for smoothing the mud floors and walls. Further, in rural areas cow dung-based gas plants (gobar gas plants) are becoming increasingly prevalent. The cow is very much tied to the well-being of the Indian farmer. Its conservation has, therefore, always been much desired and sought after.

Since very little land in India is available for open grazing and fodder production, the maintenance of cattle as a commercial endeavor has never developed as extensively as in Denmark, Australia, and the United States where cattle raising in itself is a commercial venture. As a result, livestock account for only 8% of India's national income.

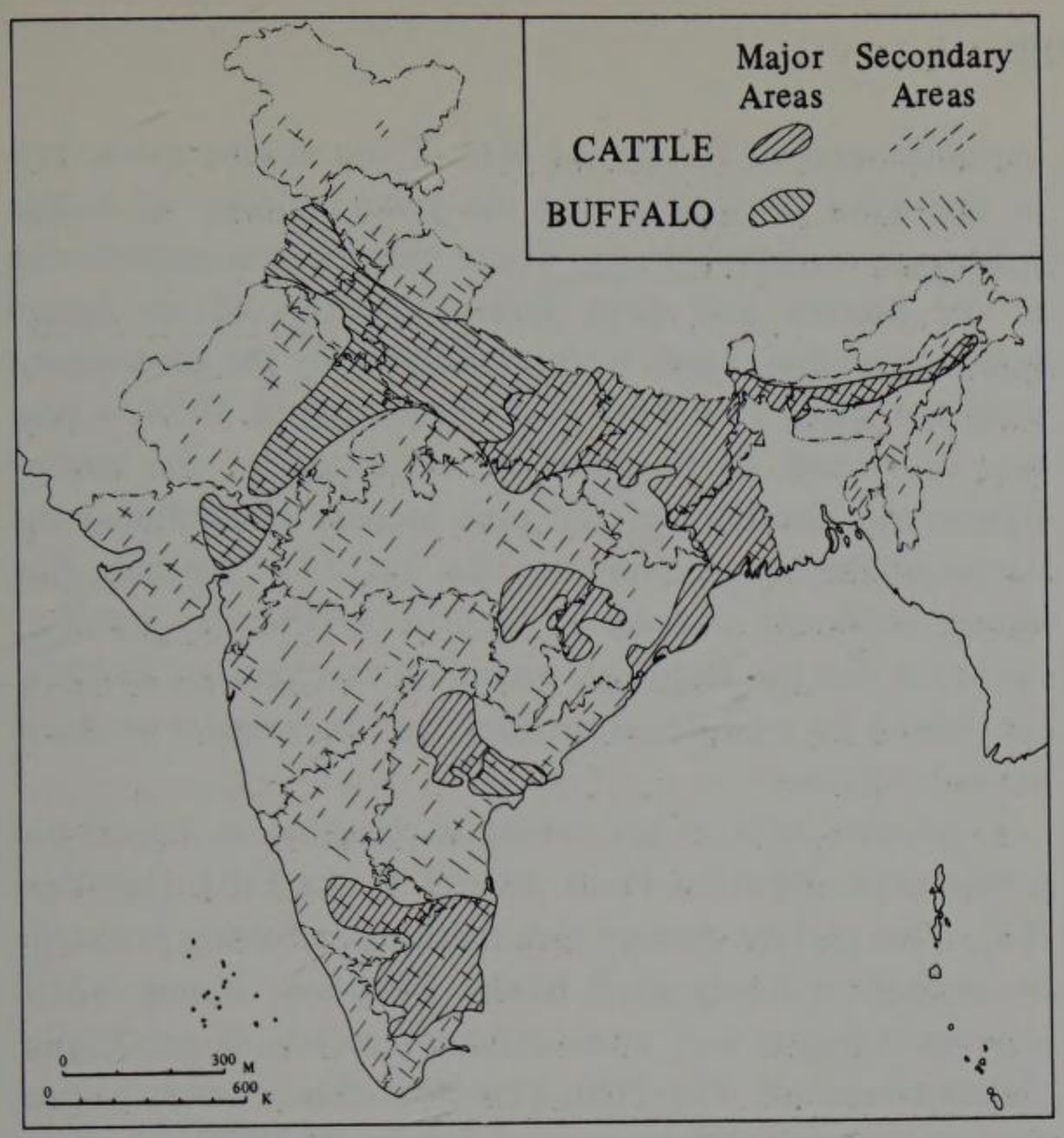
Neither bullocks nor cows are very efficiently utilized in India. It has been estimated that, on the average, between the years 1951 and 1966 a pair of bullocks was used for cultivating only 10 acres of land per year. The average milk production per cow is also very low, although the she buffalo accounts for a higher yield. She buffaloes constitute only 45% of the total breeding bovine population, but account for 55% of the milk production; their milk has a higher butterfat content than that of the cow.

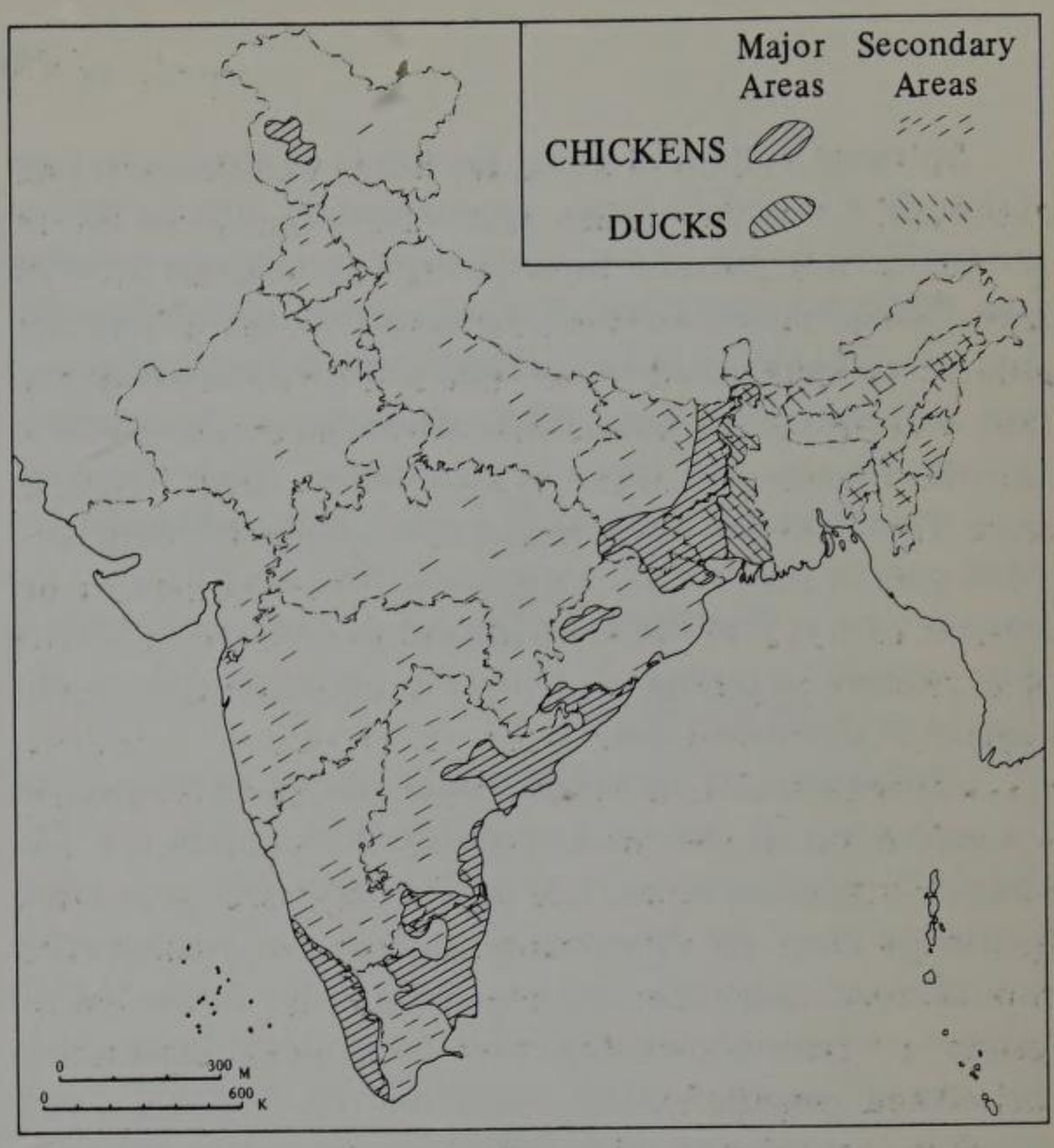
The main problems regarding India's bovine population are those of an acute shortage of feed and fodder and the lack of better breeds. The government is conscious of these problems and has initiated steps to solve them through several Five-Year Plans; intensive cattle development projects which aim at selective breeding and crossbreeding, and developing high-yielding milk animals. In 1971-72, 529 key villages were selected to operationalize intensive cattle development projects.

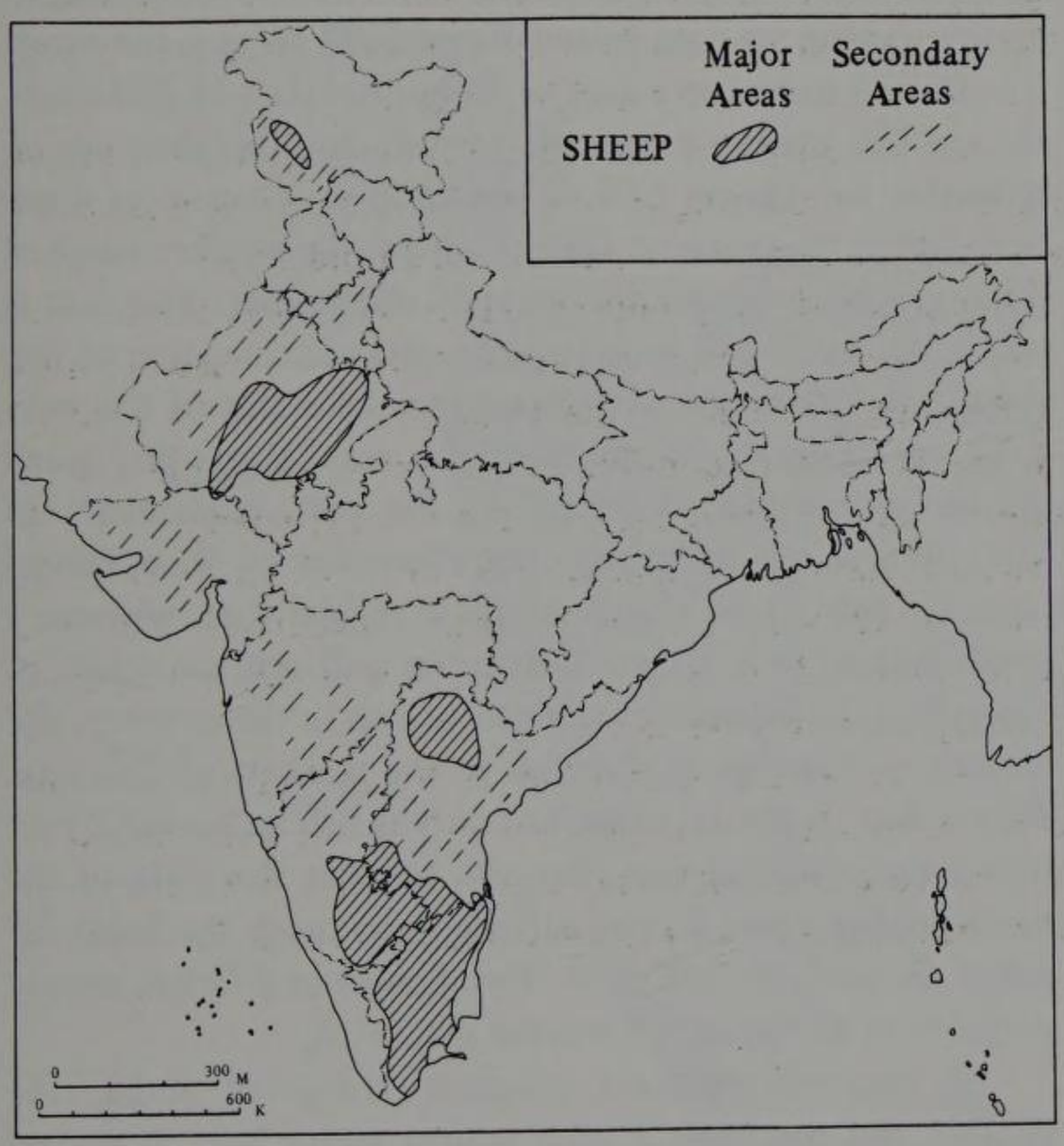
Chickens and ducks are inhabitants of a moist and year-round warm climate. According to the 1966 livestock census, there were 115 million poultry in India. The native chicken is raised primarily in the backyards of the village houses. Those who practice domestic chicken-farming are the Moslems, Christians, Tribals, and some low-caste Hindus; upper-caste Hindus do not raise chickens as a matter of tabu. Organized poultry farming oriented towards serving metropolitan markets is a post-World War II development. The commercialization of the chicken and egg trade based on commercial chicken farms has resulted in a rise in the number of poultry from 95 million in 1956 to 115 million in 1966. Egg production in 1973-74 was approximately 7.7 billion. Improved breeds of poultry have been used increasingly. As in the United States, it is the feed of the commercial chicken which accounts for most of the inputs. The feed alone accounts for 70% of the cost of egg production and 60% of the chicken and duck meat. Domestically-raised chickens live on household wastes and therefore, cost virtually nothing to feed.

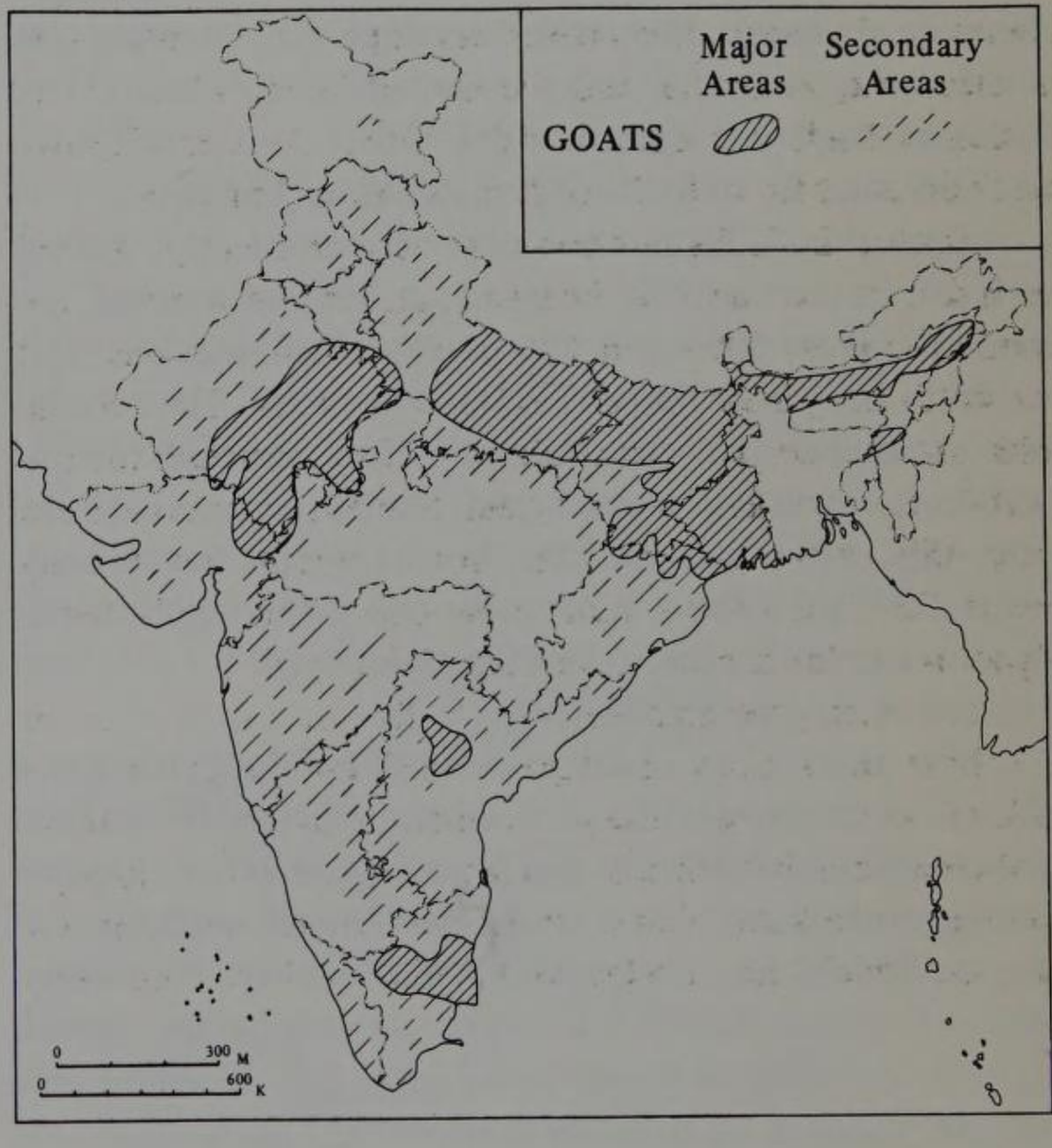
Sheep and goats numbered 42 million and 64 million respectively according to the 1966 Livestock Census. Both are used for meat, but sheep also yield India's wool supply. A Rajasthani sheep produces only 3 lb (1.4 kg) of wool per annum which is almost one-fifth of that of a sheep in Australia, New Zealand, or the United Kingdom. The Indian climate is partly responsible for the low wool output and its inferior quality. However, in the northern temperate climate of Kashmir, Himachal Pradesh, and Uttar Pradesh, better breeds yield increased output. Currently, of the total wool produced in India, only 43% is usable for apparel making; the remainder is used for carpets.

On the whole, animal husbandry in India is at a low ebb. Nonetheless, its improvement is very closely linked to the improvement in living standards, per capita income of the farmer, and in the protein content of the Indian diet.


Major Areas
Secondary Areas
CATTLE
BUFFALO
0 300 M
0 600 K


Major Areas
Secondary Areas
CHICKENS
DUCKS
0 300 M
0 600 K


Major Areas
Secondary Areas
SHEEP
0 300 M
0 600 K


Major Areas
Secondary Areas
GOATS
0 300 M
0 600 K

## FISHERIES

To many Hindus in India, the fish is an auspicious sign. Although it is widely eaten, approximately 30% to 50% of Indians do not, because of some type of religious belief or tabu. The principal content of the average Indian diet consists of carbohydrates and is significantly deficient in protein and other nutrients. Such deficiencies can result in various diseases and types of retardation. Since fish contains a considerable amount of protein and could provide a good part of the protein requirement for a healthy diet, the general view is that the development of fisheries in India is very closely intertwined with the improvement in the quality of the Indian diet.

Although India ranks seventh in world fish production its percentage of the total world catch is a mere 2.4. The country's production of 1.8 million tons (1971) is insufficient to meet the demands of the people. For adequate nourishment, nutrition experts recommend intake of 40 grams (1.4 ounces) of animal protein per day; if only fish is considered, on the average every individual in India consumes as low as six grams per day.

There are enormous resources of inland and marine fish available to India. The total culturable area of tanks and ponds is 1.6 million hectares, of which only .6 million hectares are currently being utilized. There are 16,767 miles (27,000 km) of rivers and 70,173 miles (113,000 km) of irrigation canals. From these sources, a total of .8 million tons of freshwater fish is obtained. On the average, per hectare fish production in the tanks and ponds is low, only 1,320 lb (600 kg). Marine sources are presently responsible for 1.5 million tons per annum; almost two-thirds of the country's fish catch is obtained from the sea. Further, not only does India have an extensive coastline, but along its continental shelf lies a potentially vast, unexplored reserve of fish. Currently, the Indian Ocean accounts for only four percent of the world's fish catch.

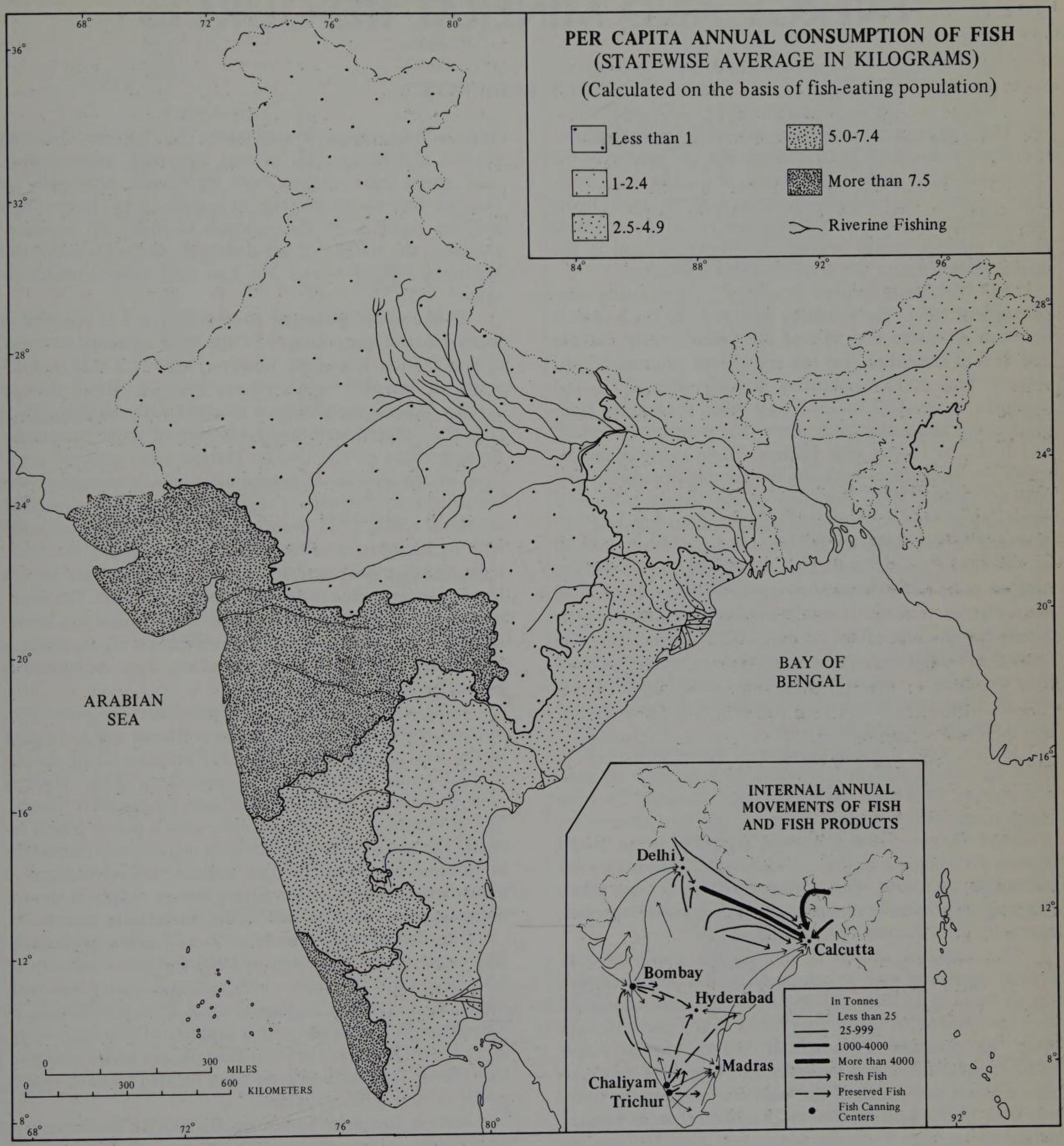
The principal difficulty of the Indian fishing industry is its lack of modernization. The inland fisheries do not have scientifically-bred fish fry and fingerlings which are capable of large-scale growth. As a result, based on the utilization of the traditional fry, the yield is low. Recently, the Central Inland Fisheries Research Institute has undertaken research into the breeding of Indian and foreign fish. Based on such culture, yields of up to 6,600 lb (3,000 kg) per hectare have been obtained. The application of such Green Revolution type fish is bound to substantially increase the fish production. This and other new methods of fish culture need to be popularized. In addition, more area needs to be devoted to the extension of culturable swamps, ponds, reservoirs, etc.

In marine fishing, traditional nonmechanized fishing methods account for almost 60% of the marine catch. It is in this kind of fishing that the great majority of Indian fishermen earn their living. These fishermen constitute one of the poorest and most deprived sectors of the Indian population; their needs were overlooked by the government until the Fifth Five-Year Plan. Beginning in 1974, a plan was developed to improve the condition of the marine fishermen. Elements of the plan include streamlining the design of the boats, improving the quality of the sails, providing outboard motors to increase efficiency, installing on-board storage facilities, providing mechanized facilities for fishing by traditional methods and making ice available at docking areas.

Another kind of sea fishing is classified as coastal but mechanized. Previous Plans, as well as the Fifth Five-Year Plan, have greatly assisted this method of fishing primarily by supplying mechanized boats. Deep-sea fishing, which requires trawlers and more efficient vessels, is gaining increasing support. The Fifth Five-Year Plan intends to produce almost 3.1 million tons of fish by 1978-79. The Plan foresees that the proportion of the total production of marine fishing vis-a-vis inland fishing will remain the same.

Of the maritime states of India, Kerala and Maharashtra are the leading producers of fish. Jointly, they are responsible for almost half of the total production of maritime fish in the country. On the whole, the western coast of India produces double the amount of the east. This fact is well reflected in the greater per capita consumption of fish (based on fish-eating population) in the states of the west coast as compared to those of the east. Moreover, much greater proportion of people in the east, particularly in West Bengal, eat fish; even the *Brahmins* of West Bengal consider fish to be a part of their regular diet, whereas a south Indian or a Gujarati Brahmin will seldom touch it. Regarding the internal movement of fish in the country, the greatest percentage is directed to the markets of Calcutta. This is due to the fact that not only is fish an essential part of the daily Bengali diet, but also because the yield of the northeastern coast is not sufficient to meet the local demand. In fact, the states of West Bengal and Orissa supply only 5% of the country's marine fish catch.

If the predominant religious group of India, the Hindus, did not have a tabu against eating beef, it is conceivable that the current protein deficiency problem could be solved with a regional strategy utilizing a meat-based protein diet in the north, and a fish-based diet in the south. As such a belief is more likely to continue, it is realistic to concentrate in the north on milk and goat meat for protein intake, and in the south on fish and mutton.


PER CAPITA ANNUAL CONSUMPTION OF FISH
(STATEWISE AVERAGE IN KILOGRAMS)
(Calculated on the basis of fish-eating population)
Less than 1
1-2.4
2.5-4.9
5.0-7.4
More than 7.5
Riverine Fishing
ARABIAN SEA
BAY OF BENGAL
INTERNAL ANNUAL MOVEMENTS OF FISH AND FISH PRODUCTS
Delhi
Calcutta
Bombay
Hyderabad
Madras
Chaliyam
Trichur
In Tonnes
Less than 25
25-999
1000-4000
More than 4000
Fresh Fish
Preserved Fish
Fish Canning Centers
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
8°
12°
16°
20°
24°
28°
32°
36°

# Chapter 4

# ENERGY AND MINERAL RESOURCES

## ENERGY RESOURCES

The development of energy sources is fundamental to the modernization of India. Energy sources consist of the traditional types such as fuel wood, dry cattle dung, vegetable wastes, and modern sources such as coal, hydel (hydroelectric power), petroleum, and atomic power. Most of the modern energy sources, except those used in the transportation sector, are converted into electricity.

The traditional sources of energy are essentially noncommercial, their use primarily restricted to the home. It has been estimated that 91% of the rural domestic fuel use and 75% of the urban fuel use are derived from traditional sources: fuel wood constituting 70%, dry dung 15%, and vegetable wastes 10% to 15%. Fuel wood is obtained from community and waste lands, trees that grow on the farms, and from the forests near villages. There is increasing demand for wood from both the burgeoning population and industrial users. Thus, depletion of the supply of trees is increasing at a rapidly accelerating rate. Four hundred million tons of wet cattle dung are converted annually into 60 to 65 million tons of dry cattle dung (equal to 25 million tons of coal) for domestic fuel use. If this supply of dung were used as fertilizer it would amount to eight times the present production of the Sindri fertilizer plant. Thus, the farmers are faced with a critical dilemma; whether to utilize the cow dung as fuel or as fertilizer. Unless fuel needs are met by alternative sources, the possibility of the extensive use of dung as fertilizer is remote.

Of the total installed capacity of power generation in India (seventeen million kilowatts), 58% comes from thermal sources, 41% from hydel, and approximately 1% from the development of nuclear resources. Thermal sources are abundant in the coal-rich eastern region of India. Hydel sources predominate in the coal-deficient south and are important in the north. The northeast, which is least industrialized and therefore requires minimal power supplies, consumes little thermal or hydel power.

The principal source of modernized energy is coal. Proven reserves of coal as computed by the Geological Survey of India in 1972 are 21.36 billion tons; estimated total reserves amount to about four times that figure. In rank order, the principal consumers of coal are electric power stations, steel mills, and the railroads. Together, they constitute about two-thirds of the total coal usage in the country. With 1973-74 production at 79 million tons, and anticipating an increase in future production, coal reserves can last for at least two centuries. The country is deficient, however, in large reserves of coking coal, which is a necessary input for the continuing manufacture of steel.

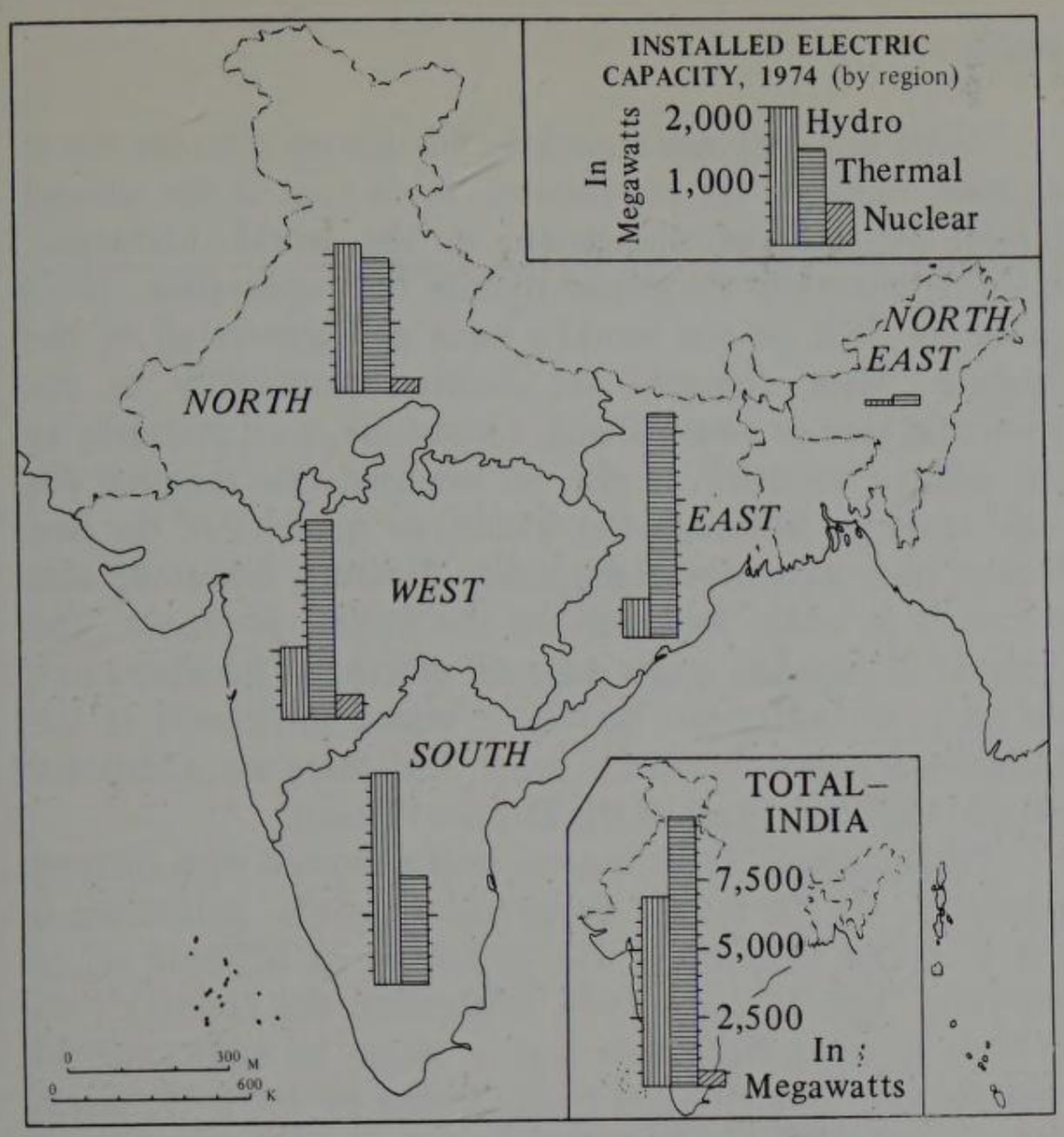
Good quality coal occurs in the northeastern part of the Deccan Plateau, specifically the Damodar and Mahanadi Valleys. This region is responsible for the overwhelming portion of India's supply of coal. Naturally, movements of coal within India emanate from these areas, principally by railroad. Due to the shortage of hopper cars in recent years and the inability of the railroads to make the necessary transfers, the states that are distant from the Damodar and Mahanadi regions receive less coal than their demands require.

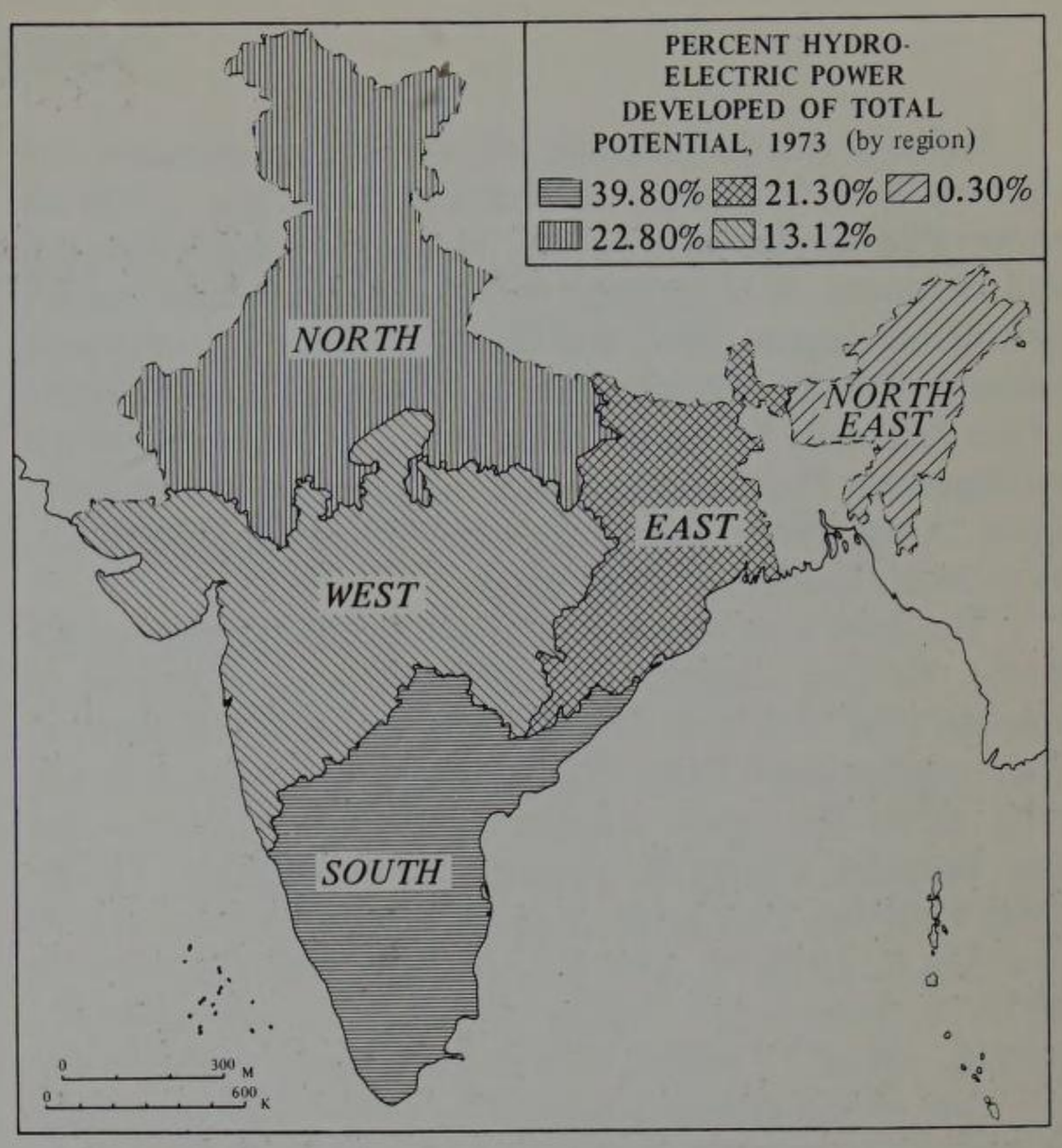
Hydel-power potential is abundant and is possible in many parts of the country. Of the total potential of twenty-five million kilowatts, however, only 7.2 million kilowatts of installed capacity have been developed due to various factors: the problems involved with managing such large-scale capital investment; the lack of large, perennially flowing rivers in the Deccan Plateau area; seasonal variations in the amount of precipitation which necessitate the construction of reservoir facilities; and the unresolved problems arising from drought years. Still, when compared with hydel capacity at the time of independence, the country's capacity has increased about thirteen times with a total of seventy-nine major hydel-power stations. The abundance of coal in the eastern region of India has not necessitated a sizeable hydel-power development there, whereas the south and the north particularly have developed a greater hydroelectric capacity.

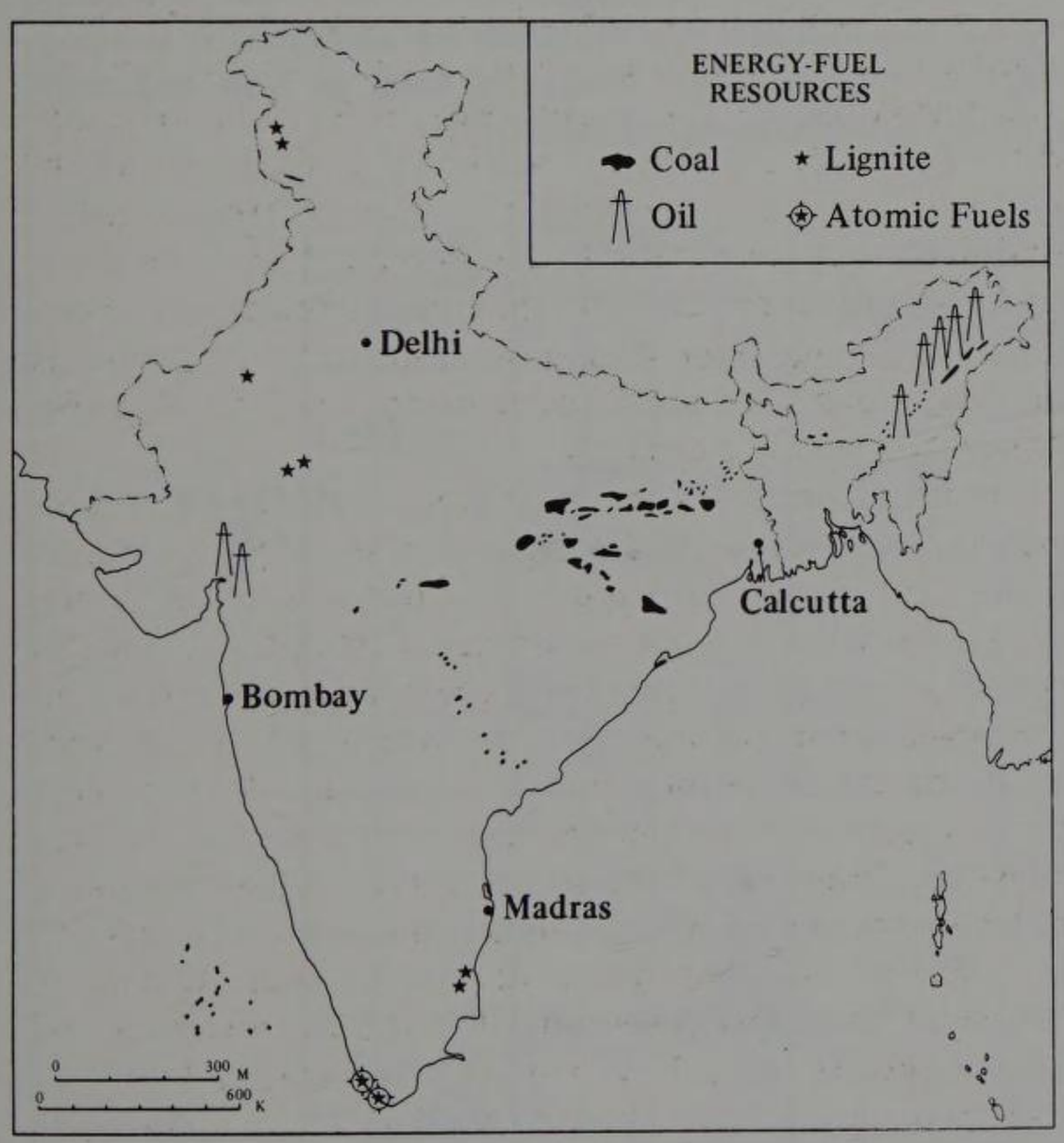
India, at present, has limited petroleum resources. Production, restricted to Assam in the northeast and to Gujarat in the west, is able to supply only one-quarter of the nation's internal consumption of petroleum. Thus, there is great dependence on foreign producers for the vital mineral. The government has now implemented a policy which restricts the use of petroleum to such unavoidable consumers as automobiles, diesel railroad engines and petro-chemical industries. Direction of the future energy supply is toward thermal power based on coal, hydel, and atomic sources.

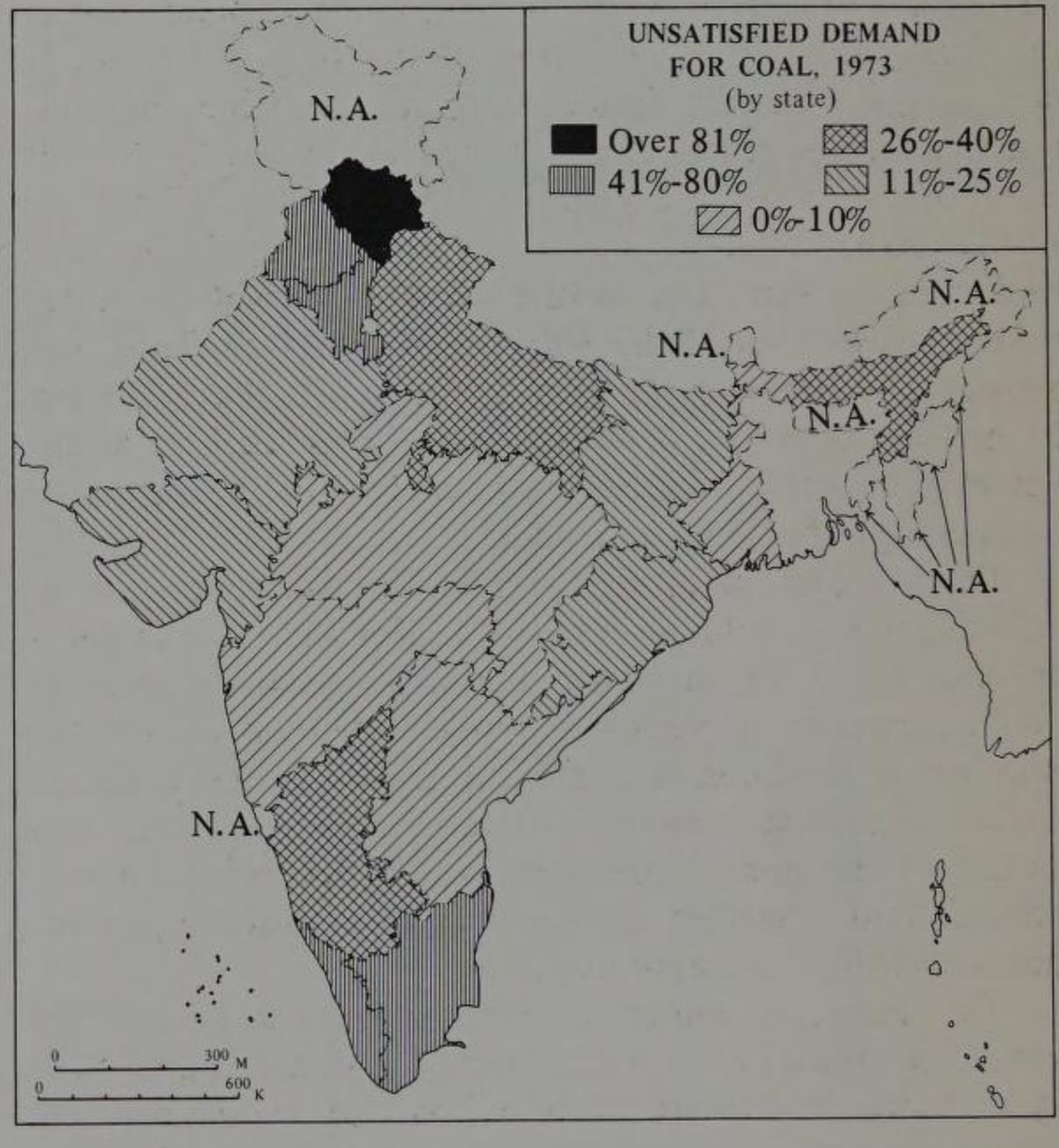
The first atomic power station at Tarapur (Maharashtra) began to supply power in 1969 and has a capacity of 400 megawatts. A facility with similar capacity has been developed near Kota in Rajasthan. A third installation, at Kalpakkan in Tamilnadu with a capacity of 470 megawatts, and a fourth at Nararo in Uttar Pradesh, are under construction. These four stations have been located so as to supply power in coal-deficient areas.

India is fortunate to possess the world's largest reserve of thorium, an atomic ore: 500,000 tons of ore containing approximately eight to ten percent thorium. The ore is located along the beaches of Kerala and Tamilnadu for a distance of about twenty miles. The two main centers of deposit are Chavara in Kerala and Manavia Kurichi in Tamilnadu.


INSTALLED ELECTRIC CAPACITY, 1974 (by region)
In Megawatts
2,000
1,000
Hydro
Thermal
Nuclear
NORTH
NORTH EAST
EAST
WEST
SOUTH
TOTAL–INDIA
7,500
5,000
2,500
In Megawatts
0 300 M
0 600 K


PERCENT HYDRO-ELECTRIC POWER DEVELOPED OF TOTAL POTENTIAL, 1973 (by region)
39.80%
21.30%
0.30%
22.80%
13.12%
NORTH
NORTH EAST
EAST
WEST
SOUTH
0 300 M
0 600 K


ENERGY-FUEL RESOURCES
Coal
Lignite
Oil
Atomic Fuels
Delhi
Calcutta
Bombay
Madras
0 300 M
0 600 K


UNSATISFIED DEMAND FOR COAL, 1973 (by state)
Over 81%
41%-80%
0%-10%
26%-40%
11%-25%
N.A.
N.A.
N.A.
N.A.
N.A.
N.A.
0 300 M
0 600 K

## MINERAL BASE

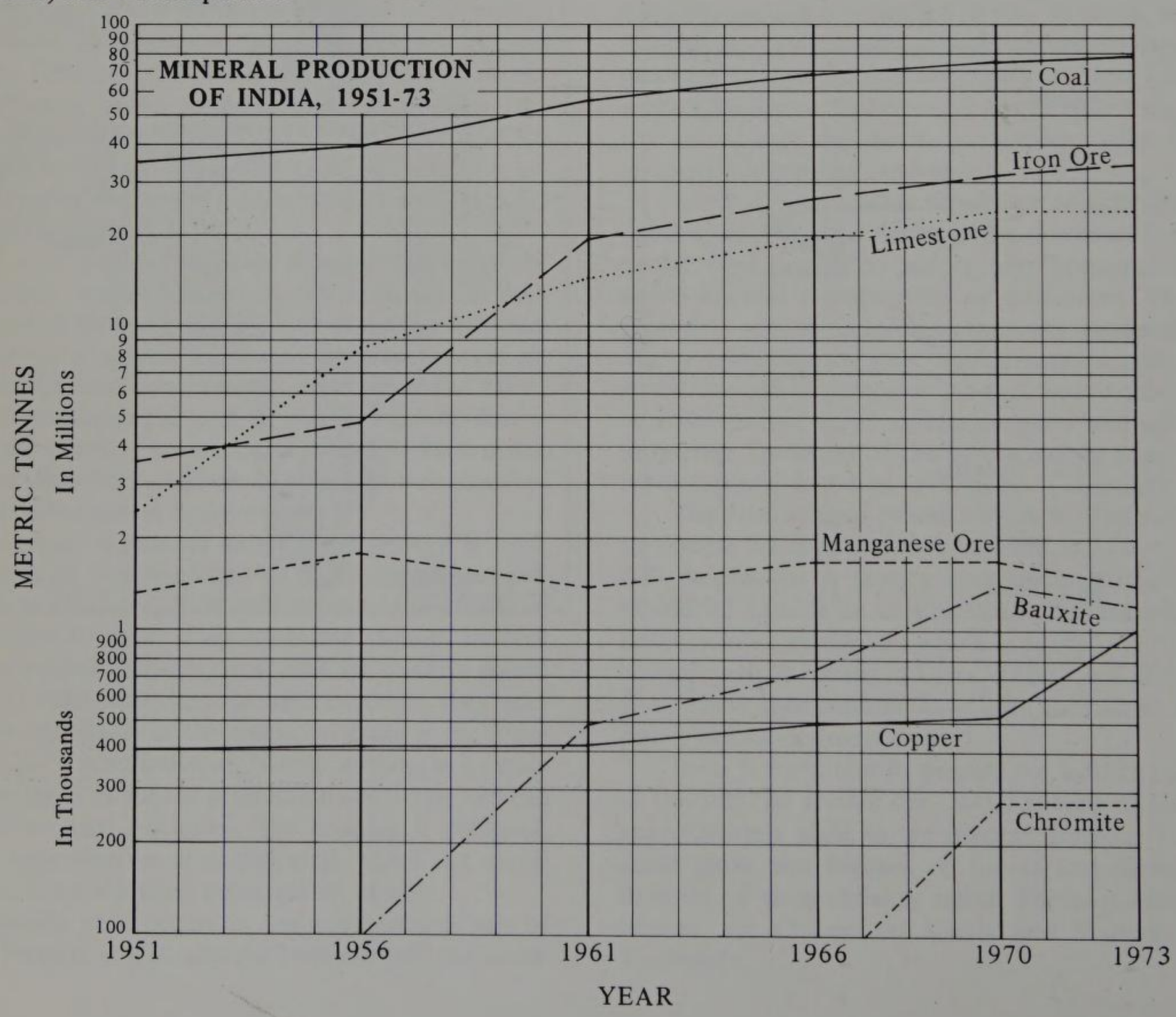
India is rich in minerals. Of the leading minerals, the country is self-sufficient in coal and limestone. It has an exportable surplus of iron ore, manganese, mica, kyanite, and chromite. It is deficient in and therefore must import petroleum, copper, zinc, and tin. The principal location of minerals is in the Deccan Plateau in association with rocks of the Paleozoic Era. Areas of specific concentration are the northeastern Deccan Plateau and the southern half of south India. A significant number of mineral-based industries are, as a result, located in those areas.

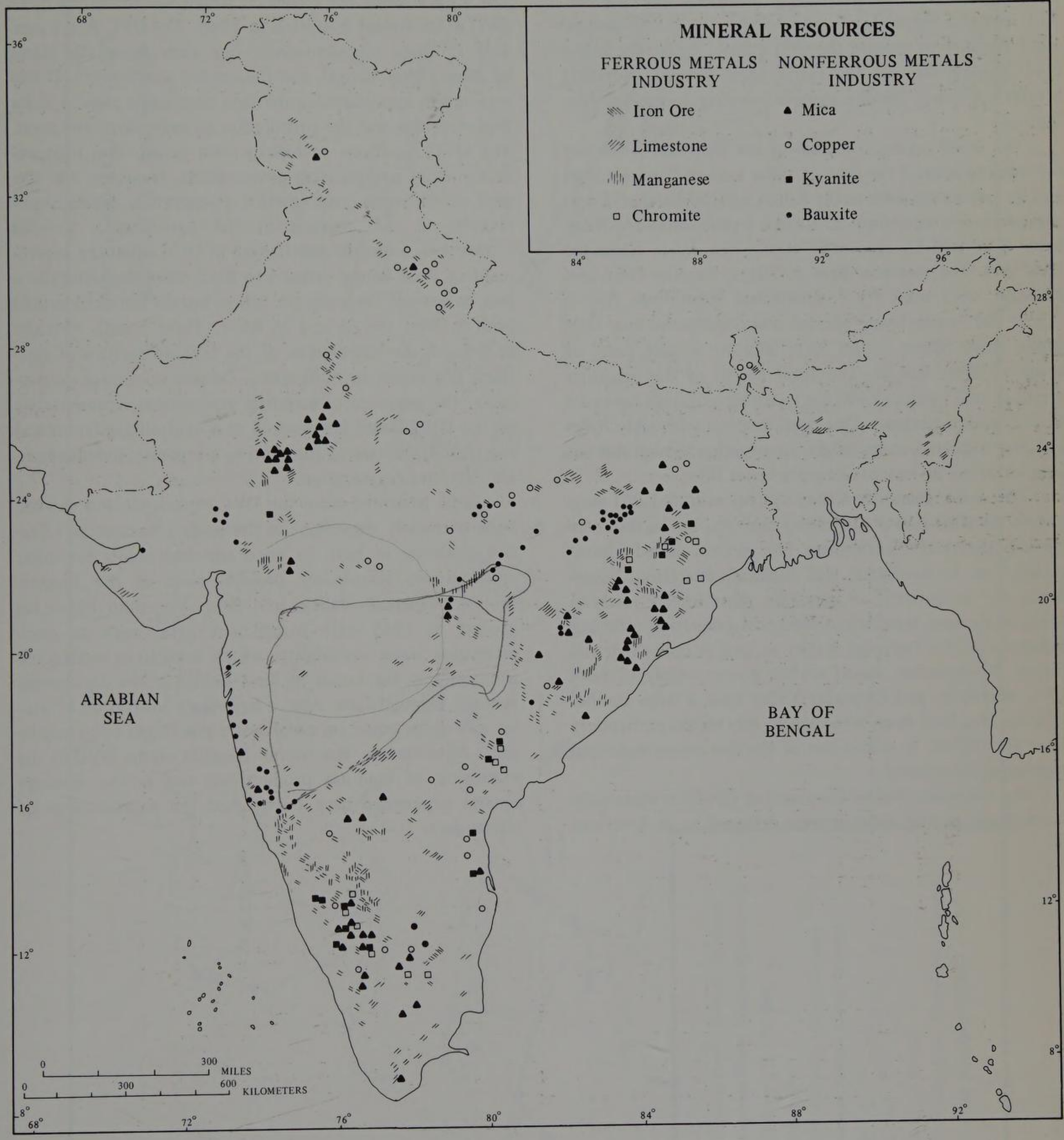
The iron ore reserves of India are the largest in the world. Of this reserve, 8.1 billion tons are estimated to contain over 55% iron content (Fe), which is indicative of high quality ore. Thus, the quantity of the resource not only meets the entire internal needs of the country, but also provides a sizeable quantity for exportation. Of the Fifth Five-Year Plan production target of 58 million tons of iron ore in 1978-79, 63% is expected to be exported. In 1973-74, twenty-two million tons of this ore were exported, out of 37 million tons of the country's production.

One of the principal barriers to large-scale exportation has been the general occurrence of ore deposits (except in Goa) in the inaccessible interior, and the lack of efficient transport connections with a seaport. Concerted efforts have been made, however, to construct railroad facilities to provide linkages from mineral deposit to port, such as in Paradip (Orissa) and Visakhapatnam.

India not only has abundant manganese reserves, but it exports most of its production. In fact, it is the second largest exporter of manganese in the world. Chromite, kyanite, and mica are mined mainly for exportation. India produces 75% of the world's mica and almost all of the kyanite. Mica deposits are located principally in the Kodarma area of south Bihar. Limestone, used primarily in the cement industry, is also an essential raw material for steel making. Although the Vindhyan quarries of the Son Valley have extensive high-quality deposits, limestone also is found in other locations on the Indian peninsula. The reserves of bauxite, a raw material utilized in the aluminum industry, are adequate. Bauxite is mined principally in the Lohardaga region of south Bihar, but there are additional deposits in other areas of the Deccan Plateau.

On the whole, India is quite well endowed with mineral resources. Of the vitally important minerals, petroleum is the principal deficiency. The discovery of offshore oil in Bombay High in early 1975 brightened the country's oil picture because from this source alone an additional 14 million tons annually will be produced by 1978-79, bringing production from the internal sources to almost 75% of the country's total consumption. On the whole, the country has the requisite raw materials for an extensive development of mineral-based industries such as iron and steel, aluminum, and coal-based fertilizer.




MINERAL RESOURCES
FERROUS METALS INDUSTRY
Iron Ore
Limestone
Manganese
Chromite
NONFERROUS METALS INDUSTRY
Mica
Copper
Kyanite
Bauxite
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

## DAMODAR VALLEY CORPORATION

The Damodar River, like the Huang Ho of China, was known as a "River of Sorrow." Annual flooding caused by the Damodar in West Bengal was notorious and frequent. As a result of the severe flood of 1943, the British government decided to harness the river's flow. Each year as the river flooded, swamps and marsh areas formed, providing breeding grounds for the malaria carrying anopheles mosquitoes.

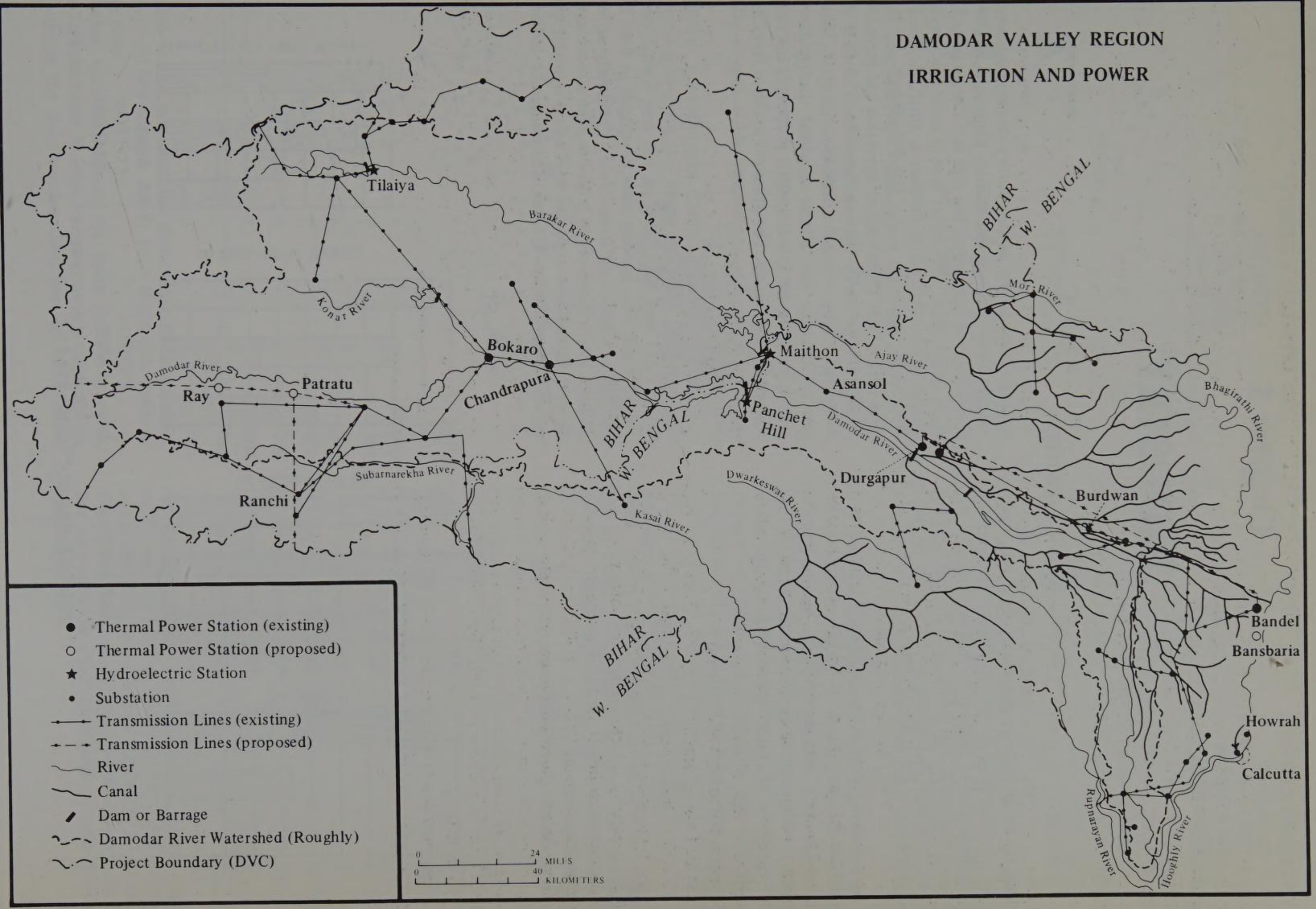
The flood control program of the Damodar River was intended to control the flow of water both in the main river and its tributaries such as the Konar and the Barakar. Dams and reservoirs were built to reserve water during the monsoon rains and to eventually release the water when the rains end. The reservoir sites at Tilaya, Panchet Hills, and Maithon were used for hydroelectric generation. And a 2,262′ (692 meter) long barrage was constructed near Durgapur from where canals were dug to irrigate parts of southern West Bengal. The total length of the irrigation canals is 1,673 miles (2,695 km) with an irrigation potential of .37 million hectares. One canal meets the Hooghly River and was expected to be used for navigation though this has been impeded by lack of adequate water flow.

The entire Damodar Valley system with its 1,061 megawatts installed power generating capacity, has an interconnected electrical transmission line system based almost equally on hydroelectric and thermal generation. Sometimes the irregularity of monsoon rains lowers reservoir levels and causes insufficient electrical generation affecting industries in the Damodar Valley as well as in the Calcutta region. Nevertheless, based on the power supply of both DVC electricity and Damodar Valley coal, a large number of industries have been attracted to this region particularly since the 1950s. It is also one of the five major industrial regions of the country.

The Damodar Valley Corporation (DVC) is essentially a multipurpose river-valley project designed by an American Engineer, William Voorduin, who was brought to India from the Tennessee Valley Authority in the United States. The TVA formed the model on which Voorduin based the DVC at its formal inception in 1948. The DVC Board consists of three representatives; one each from the states of Bihar, West Bengal, and the central government. It was involved in implementing the first river basin plan in India that encompassed the jurisdiction of more than one state. The DVC functions within its own jurisdiction independently from participating governments. However, the success of tripartite governmental cooperation depends primarily on the attitude of the participants. In this connection, a disagreement began in 1956 when the government of West Bengal refused to fund more than four dams and, as a result, state electric power boards were established both in West Bengal and in Bihar. These boards virtually challenged the jurisdiction of the DVC in matters of electrical generation in both states. Despite continued controversy, the presence of a central government representative on the DVC Board has worked as a neutralizing factor and the DVC continues to function as a separate, independent, and effective organization.

India benefited from the DVC experience and this has been extremely important as the project became an effective guideline in both its good and bad points for other multipurpose river-valley projects such as the Bhakra-Nangal, Mahanadi Valley, and Kosi. Voorduin began his project in 1945 with insufficient data, such as overestimating water availability, which resulted in inadequate water supply for canals in West Bengal in the dry season, January through June. Also, a large-scale cultivation of winter *rabi* crops based on canal water was found to be impossible. Nevertheless, the overall benefits of the DVC in the expansion of land-use productivity and in the developmental experience have outweighed the shortcomings of the project.

## DAMODAR VALLEY REGION
## IRRIGATION AND POWER



# Chapter 5

# INDUSTRY

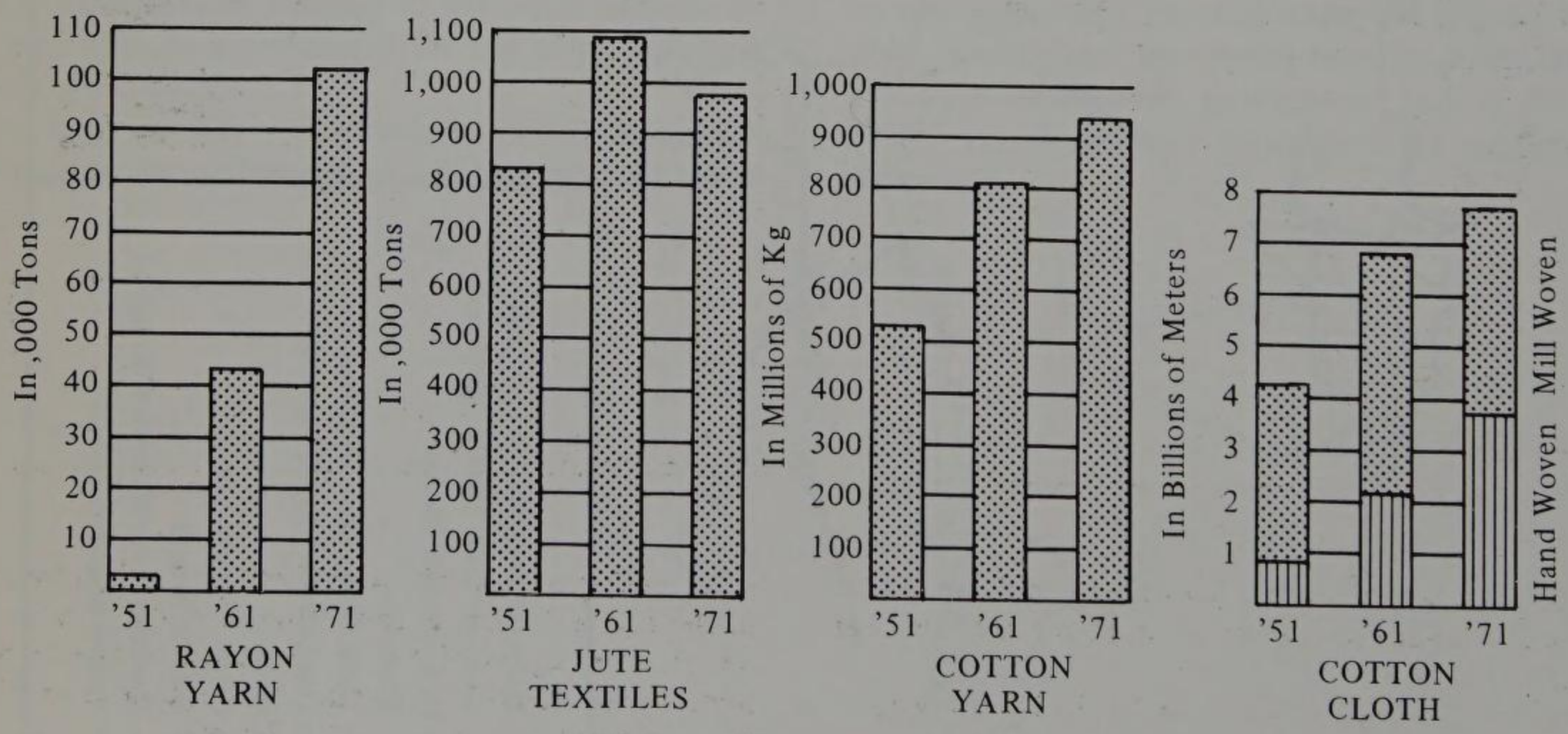
## TEXTILES

As long ago as the eighteenth century, India was world-famous for its production of fine handwoven muslins and silks. The introduction of the factory manufacturing of textiles, however, began just over a century and a half ago. The first cotton mill was established near Calcutta in Fort Gloster in 1818, and a jute mill, also near Calcutta in Rishra in 1859.

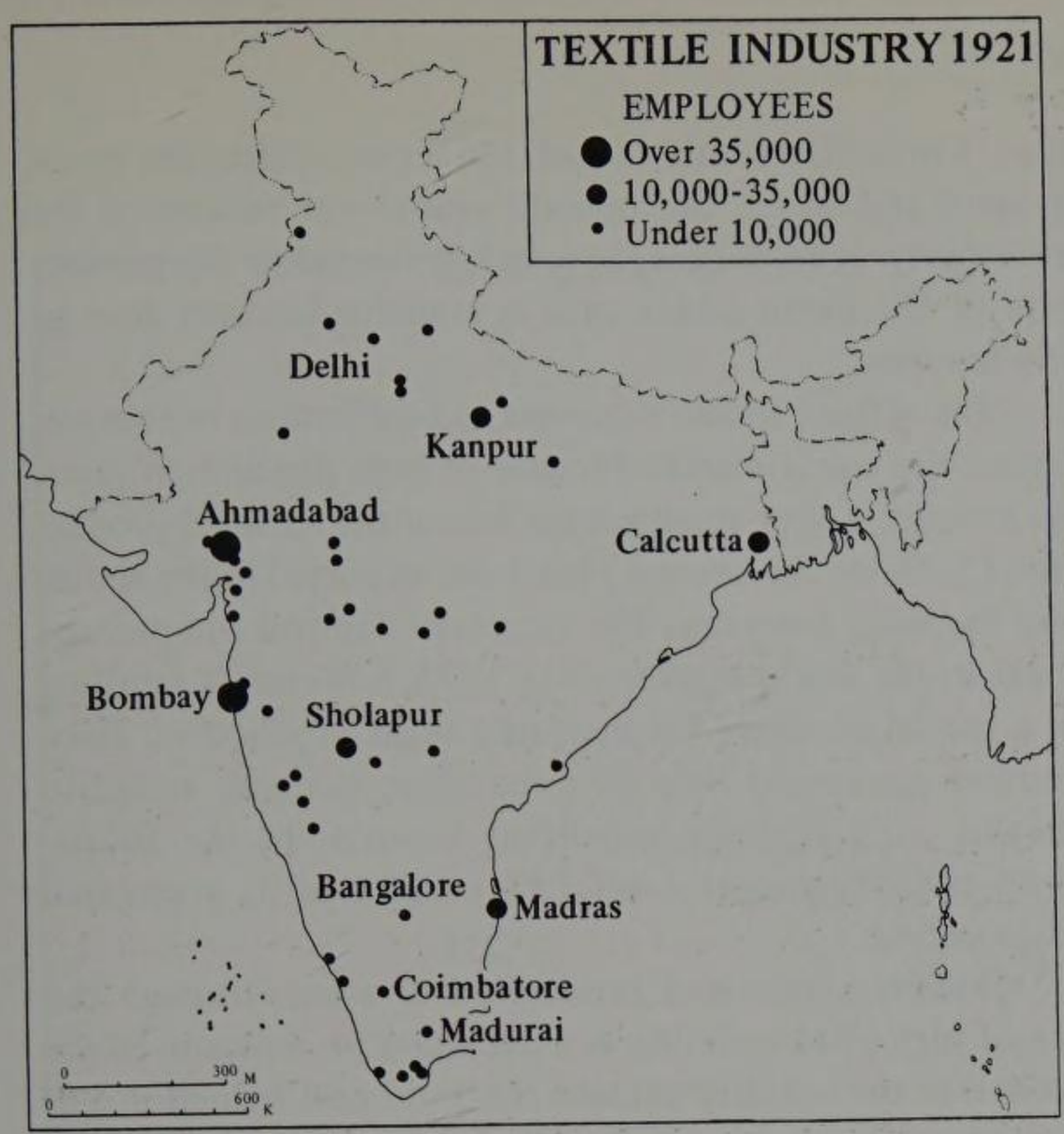
By the beginning of this century, both the cotton and jute industries had localized near their raw material sources: cotton in the Bombay-Ahmadabad region and jute in the Calcutta metropolitan area along the Hooghly River. By the 1960s the cotton industry had expanded north and south following both local raw material availability and market demand. The eastern region of India, where the wet climate is unsuitable for cotton cultivation, has developed only sporadic cotton manufacturing centers such as Calcutta. In the case of jute, however, the Calcutta area has remained the principal center with over 90% of the nation's mills. Jute cultivation has remained mainly concentrated in the Ganges delta because of the region's particular climatic, soil, and hydrologic suitability.

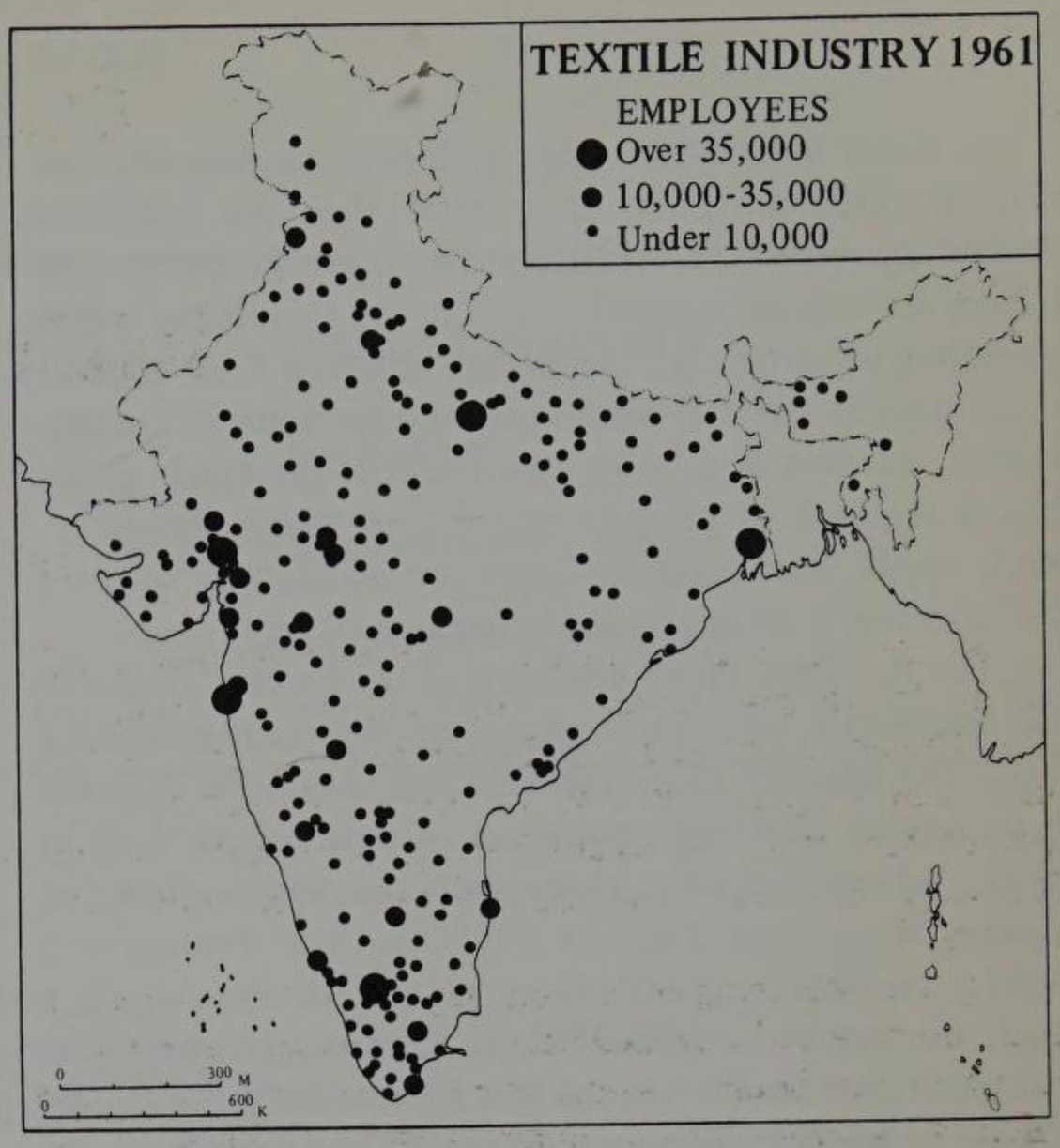
Cotton textile mills numbered 674 in 1972. The cotton industry is the largest in the country employmentwise, with a work force of almost one million. Currently, this industry is divided into two types, the mill and decentralized handloom clothmaking. The latter type is most often located in villages and conducted by families as small, localized units, often using mill-made yarns. Since independence, the rate of growth of the decentralized operation has exceeded that of the mill, primarily because handwoven cloth is less expensive to purchase than the manufactured cloth. Mill-made yarn production has almost doubled during the same period, however, because a sizeable portion of the output is utilized by handlooms. The principal problem faced by mill operators is obsolete machinery which retards effective productivity.

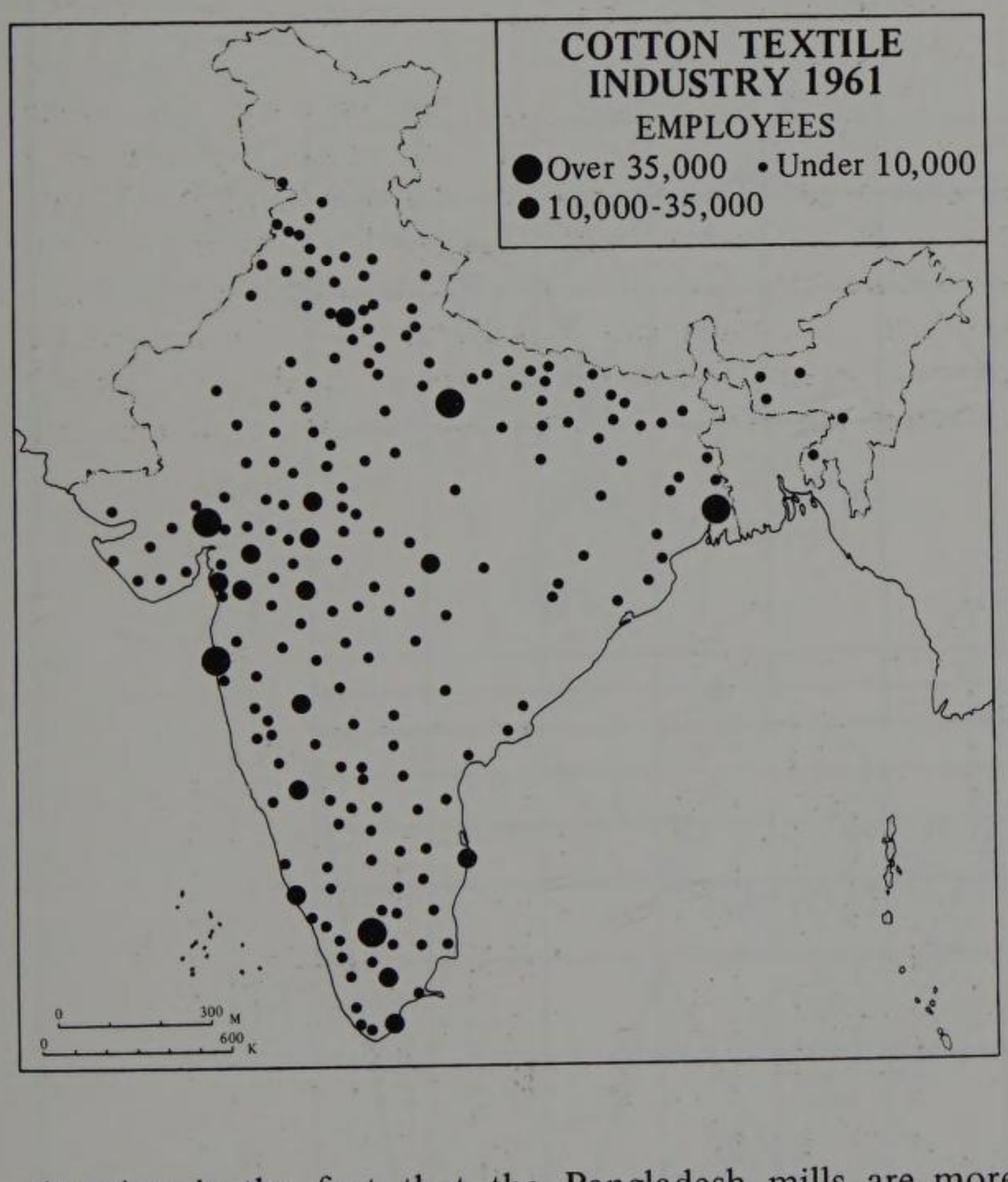
The jute industry, which experienced a catastrophe after partition, when the prime jute-producing areas were incorporated into East Pakistan, has now reestablished its base with raw jute growing areas developed in West Bengal and other neighboring states. Jute is primarily an export product. Its manufacture in India has been almost static for the past twenty-five years because world demand has not increased significantly. Further depressing the Indian jute

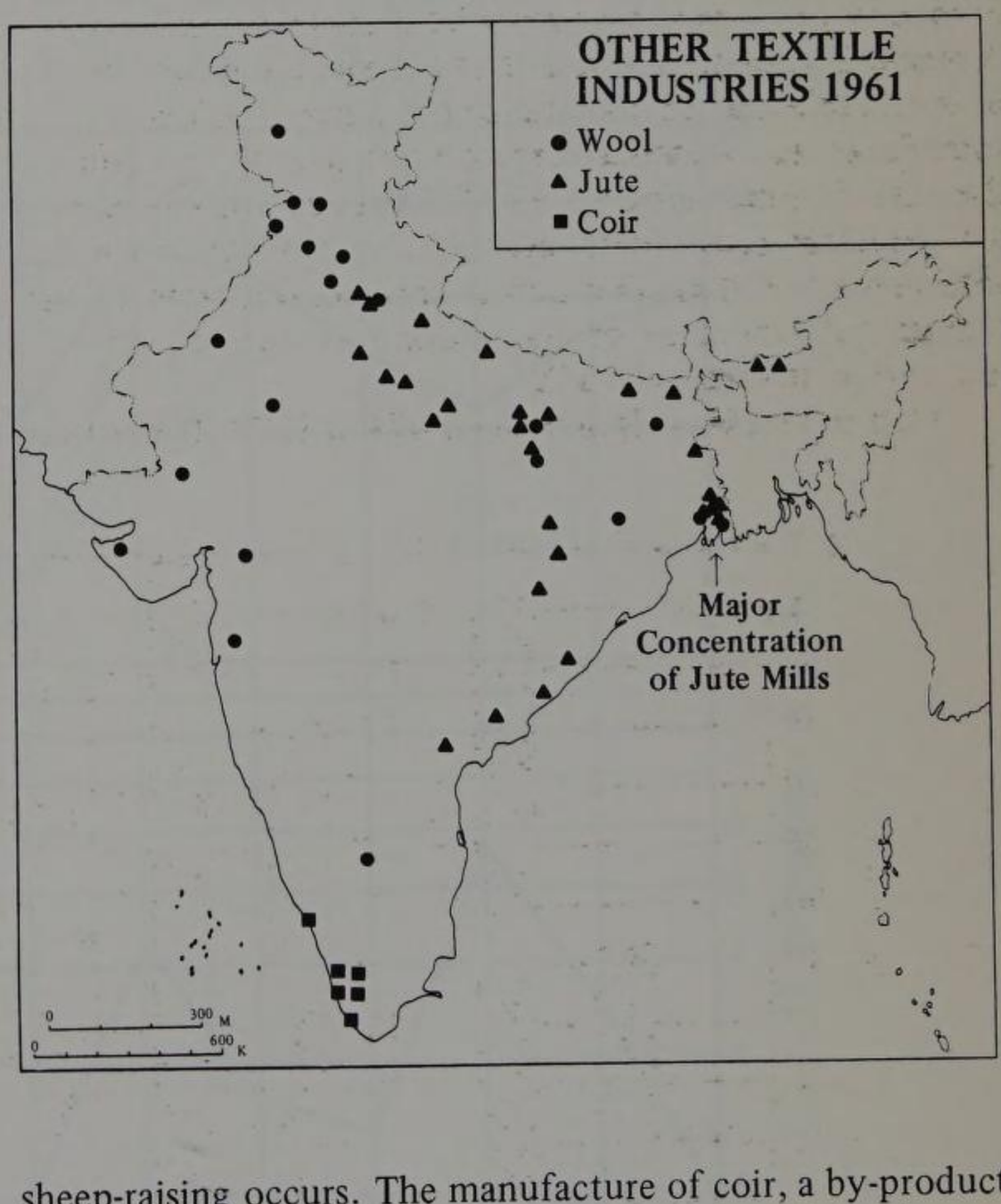



**TEXTILE PRODUCTION 1951-71**




situation is the fact that the Bangladesh mills are more modern and are located nearer to a better raw material supply base.

Other textiles produced in India include woolens, rayon, silk, and coir. Woolen manufacturing is concentrated primarily in the drier northwestern part of India where sheep-raising occurs. The manufacture of coir, a by-product of the coconut husk, is concentrated in the principal coconut-growing region of Kerala. In terms of rate of production, rayon, which began with a very low base in 1950-51, has witnessed the most spectacular growth because of increasing demand.

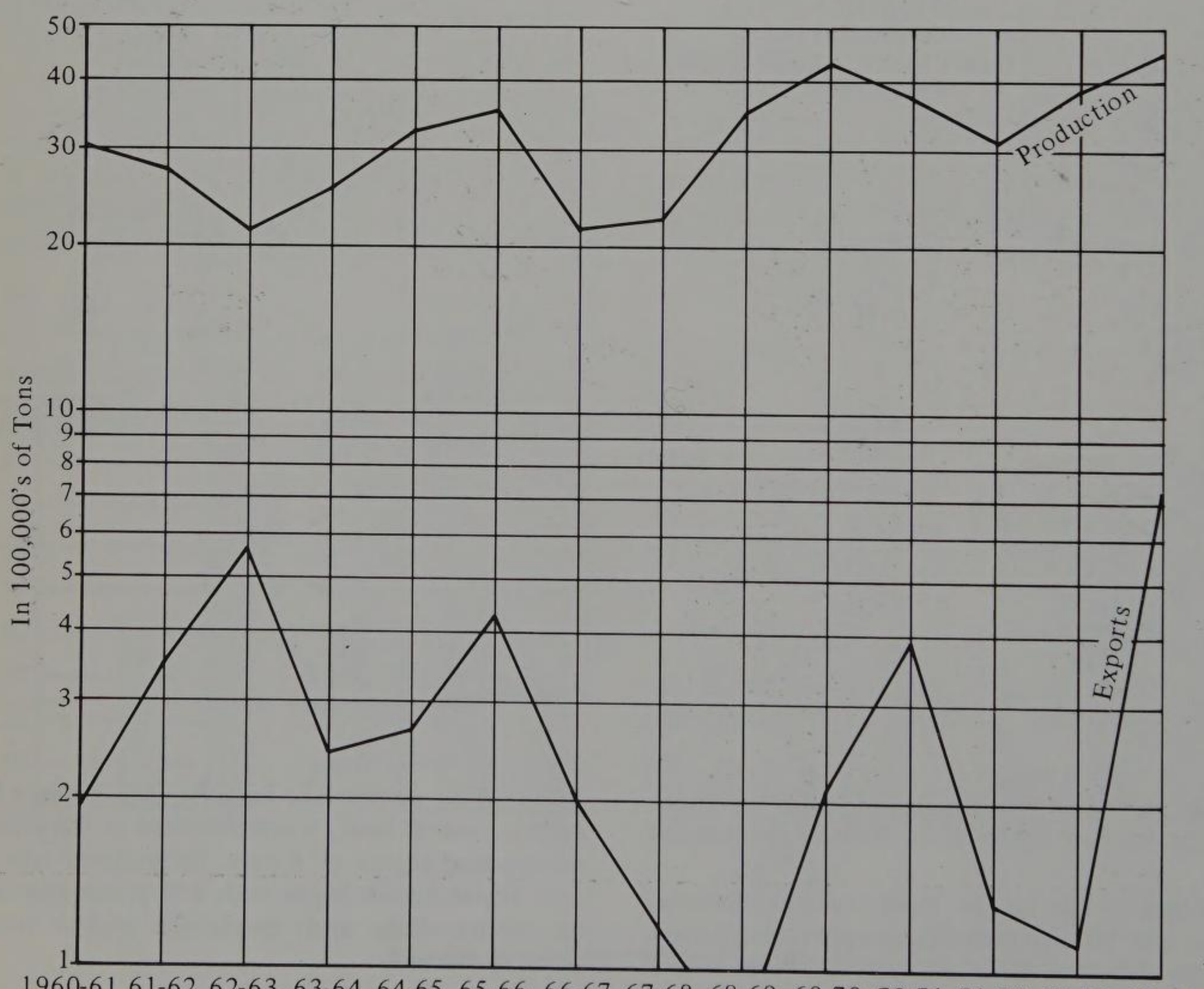
## SUGAR INDUSTRY

In terms of location, sugar refineries are basically raw material oriented. First, it is vital that the sugarcane reaches the refinery immediately after harvesting, otherwise it loses its sucrose content, resulting in an inferior sugar-generating potential. Best results are obtained if the transfer of the cane is effected within twenty-four hours of cutting. Second, as cane is a bulky raw material (as much as ten tons is required to produce one ton of white sugar granules), costly transportation costs are avoided by locating the refineries in close proximity to the producing areas.

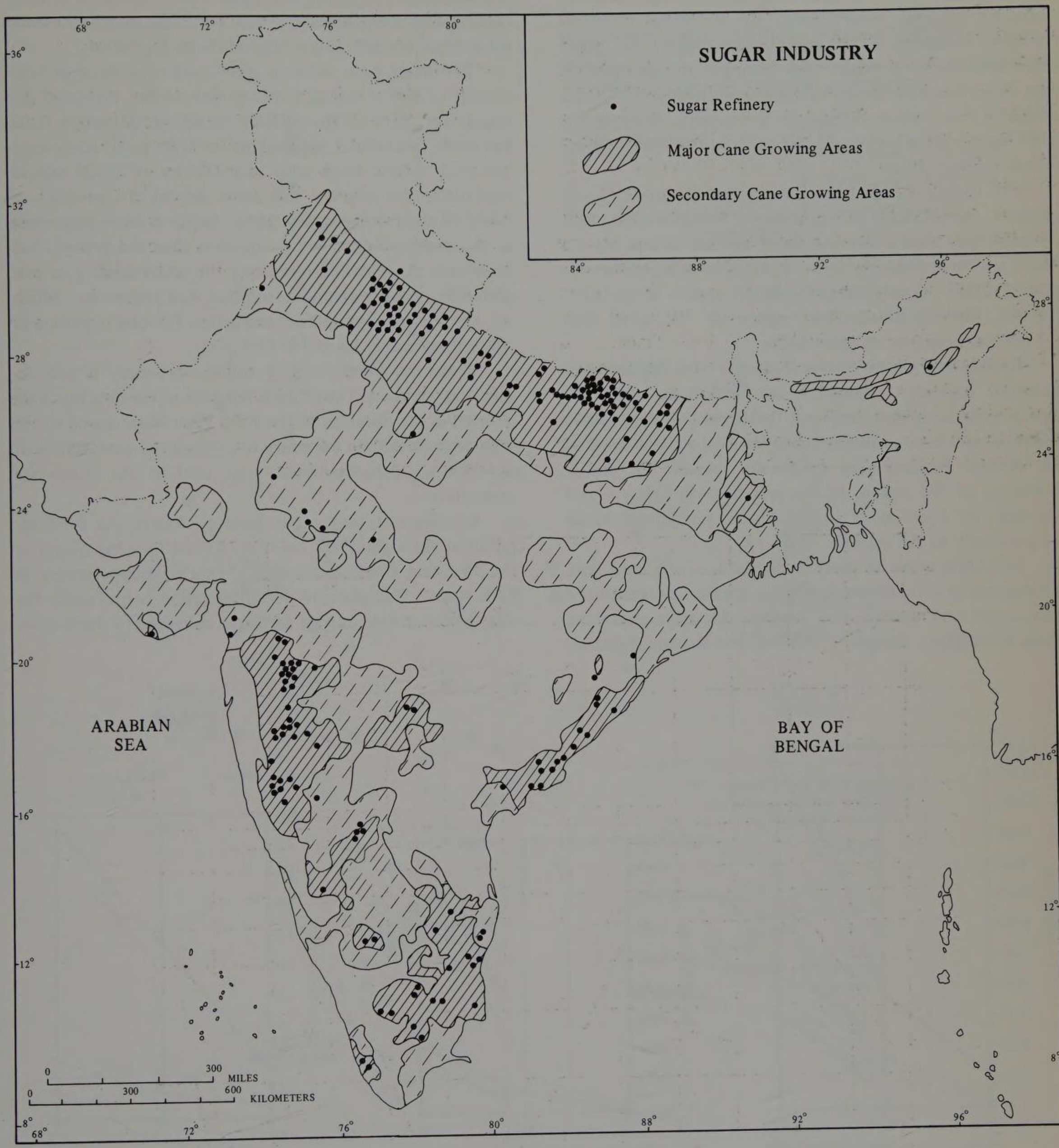
The Northern Plains and parts of the Eastern Plains are the traditional and most important sugarcane-producing areas. The industry first originated and became localized in these regions after the imposition of a protective tariff in 1932, which virtually eliminated the importation of cheaper sugar from Java. In 1931-32, Uttar Pradesh and Bihar accounted for over ninety percent of the country's total production of refined sugar. Climatically, however, this traditional area is not the best for maximum yield. The climate of south India is more favorable, and there has been a tendency toward a southward shift of sugarcane production. Currently, south Indian refineries, which are more modern and which can operate year-round because of the availability of fresh cane, have nearly overtaken the production of the north where cane is available for only four to five months.

The refined Indian sugar has had difficulties in competing on the world market because of high production costs. As a result, a very small proportion of the national production (2.7% on the average) has been exported in the sixties and the early seventies. The increased demand and price of sugar in the world market since 1974, however, is resulting in a special incentive for increased sugar production. Thus, another agro-based item of importance has been added to the list of potentially important exports. In the future, India plans to export from 15% to 20% of its granulated sugar output.

However, increased production of sugar, through the use of high-yield varieties, is a necessary prerequisite to the growth of the industry because it assures cost reduction and minimizes the competition with food grain production in terms of competing land uses.




**PRODUCTION AND EXPORTS OF SUGAR**


SUGAR INDUSTRY
Sugar Refinery
Major Cane Growing Areas
Secondary Cane Growing Areas
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

## CHEMICAL INDUSTRIES

Chemical industries, insignificant before India's independence, have now become important in the wake of increasing internal requirements for industrial chemical products, consumer goods, and pharmaceuticals. No other industry provides a more vivid example of rapid growth than drugs and pharmaceuticals; its production in 1973 was valued at four billion dollars, an increase of 25 times the 1948 figure. India is virtually self-sufficient in the manufacture of modern drugs.

The chemical industries produce the basics (acids and alkalies), petrochemicals (methanol, formaldehyde, and styrene), and coal derivatives (coal tar and carbon black). There are three principal areas of manufacturing concentration: (1) the Calcutta-Durgapur-Sindri region in the east; (2) the Bombay-Baroda-Pune region in the west; and (3) the southern part of south India.

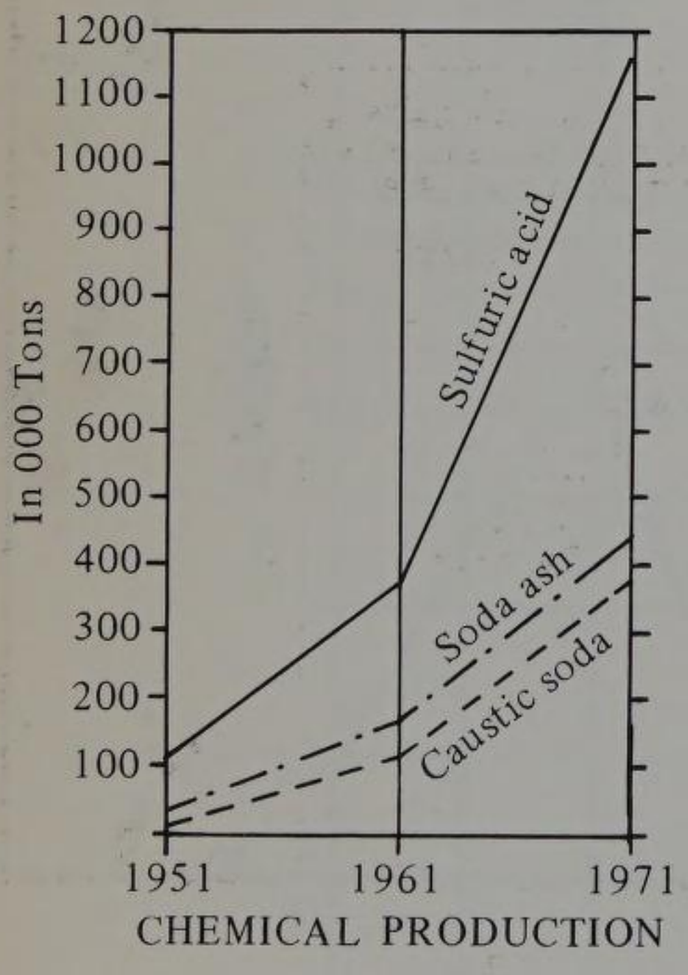
Rubber and plastic products are the most important in Calcutta. Bombay's specialities are medicinals, cosmetics, coal chemicals, rubber, and basic industrial chemicals. Basic chemical and soap manufacturing are also concentrated in the Greater Bombay area specifically to serve the textile industries of the region. In the case of both Calcutta and Bombay, the location of the chemical industries was based on proximity to the market.

Individual cities in south India do not have large concentrations of manufactures; instead, they are decentralized into small- and medium-size centers, the most important being Ernakulam, Bangalore, Madras, and Ramanathpuram. The main reasons for locating the industries in this area are the availability of cheap hydroelectricity and labor in association with a sufficiency of raw materials such as coconut oil, rubber, sea salt, and softwoods from the forests.

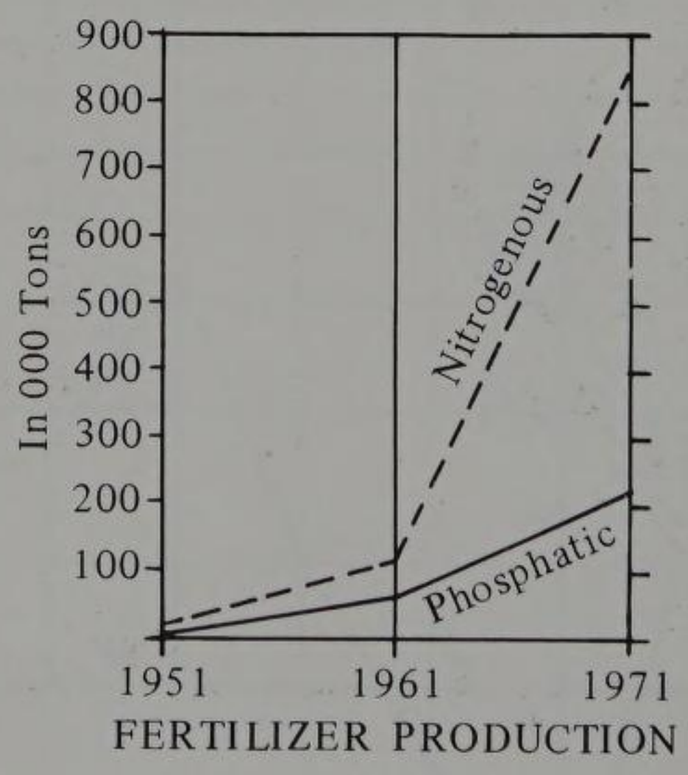
Fertilizers have recently developed into an important branch of the chemical industry due to the increased demands for them by the agricultural sector. Although India has made spectacular progress in fertilizer production since the early fifties when only one factory at Sindri was in operation, the country still must import the product to fulfill its current needs. The public sector is more important in the country's fertilizer production than the private, but both face the identical problem: the unavailability of raw materials. Rock phosphate, sulphur, and petroleum, which are among the raw material requisites, must be imported in substantial quantities and at high cost.

Given the current supply and the economy of production, petroleum will constitute the base of the new fertilizer plants for the duration of the Fifth Plan. With regard to the long term, it will be necessary to explore the possibilities of developing internal sources, e.g., coal as the main raw material base.

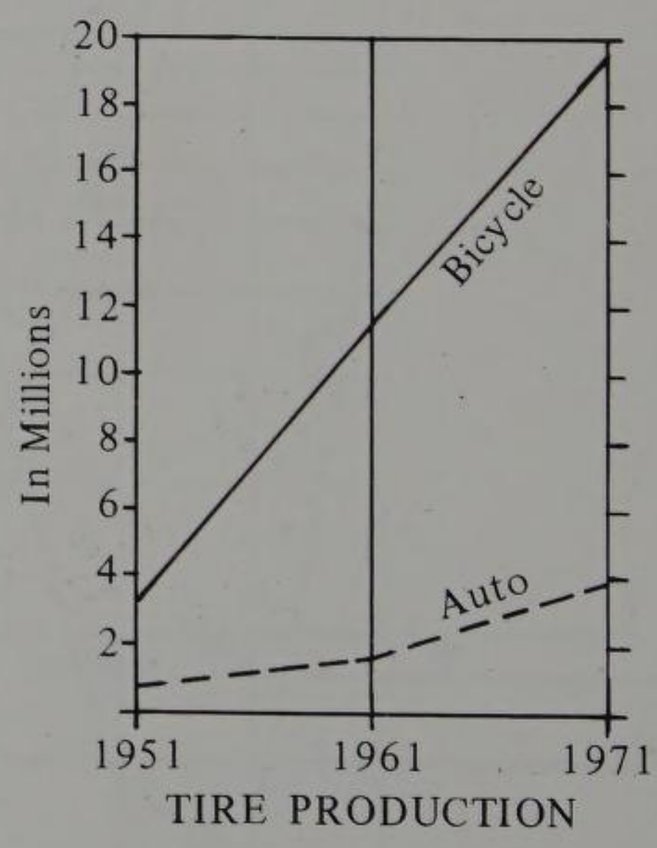
Government policy has been to locate the fertilizer factories throughout the country. At one time the slogan of the Planning Commission was: "One fertilizer factory in each state." This planned decentralization helps reduce the transport cost per unit of fertilizer delivered to the farmer.



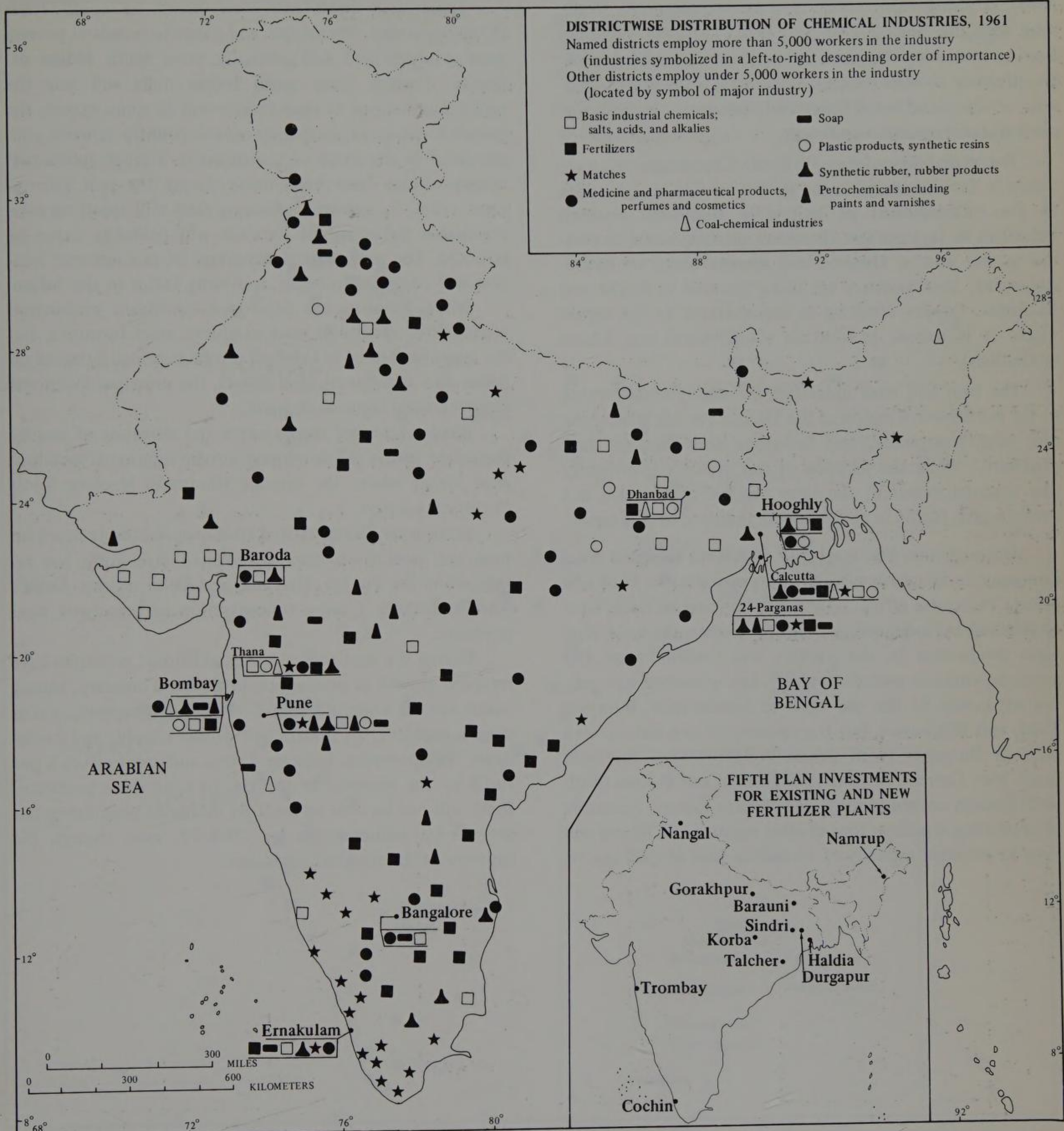
CHEMICAL PRODUCTION



FERTILIZER PRODUCTION



TIRE PRODUCTION


DISTRICTWISE DISTRIBUTION OF CHEMICAL INDUSTRIES, 1961
Named districts employ more than 5,000 workers in the industry
(industries symbolized in a left-to-right descending order of importance)
Other districts employ under 5,000 workers in the industry
(located by symbol of major industry)
Basic industrial chemicals; salts, acids, and alkalies
Fertilizers
Matches
Medicine and pharmaceutical products, perfumes and cosmetics
Coal-chemical industries
Soap
Plastic products, synthetic resins
Synthetic rubber, rubber products
Petrochemicals including paints and varnishes
Dhanbad
Hooghly
Calcutta
24-Parganas
Baroda
Thana
Bombay
Pune
Bangalore
Ernakulam
BAY OF BENGAL
ARABIAN SEA
0 300 MILES
0 300 600 KILOMETERS
FIFTH PLAN INVESTMENTS FOR EXISTING AND NEW FERTILIZER PLANTS
Nangal
Namrup
Gorakhpur
Barauni
Sindri
Korba
Talcher
Haldia
Durgapur
Trombay
Cochin
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

## STEEL AND OTHER METAL-BASED INDUSTRIES

Metal-based industries have progressed at a rapid rate since independence, principally to satisfy the country's own needs resulting from accelerated industrialization. Beginning with the Second Five-Year Plan (1956-61), there has been an increasing emphasis on heavy industry with particular reference to steel-making. While steel is the most important of the metal-based industries, the aluminum and copper industries are also significant.

The availability of bauxite in the Chotanagpur Plateau, Salem in Tamilnadu and in the vicinity of Goa has given rise to the establishment of large-scale aluminum smelting industries in Jaykaynagar (Burdwan district) based on thermal power and in Hirakud and Alwaye based on hydroelectricity; new smelters are being planned at Korba and Ratnagiri. Copper smelting is concentrated in the region where it is mined, in Ghatsila (Singhbhum) and Khetri (Rajasthan).

The iron and steel industries are mainly concentrated in the northeastern region of the Deccan Plateau where iron ore, coal, manganese, and limestone are found in close proximity. While the location of this industry is primarily raw material oriented, the large market of Calcutta is a definite plus factor in attracting the industry to this region.

Although the first steel mill (the Tata Iron and Steel Company in Jamshedpur) went into operation in 1911 as a private enterprise effort, only two additional factories were established by independence in 1947 when the total steel ingot production for the country was 2 million tons. The postindependence period, however, has witnessed not only the expansion of the old mills at Jamshedpur, Burnpur-Kulti, and Bhadravati, but the opening of new state-owned mills in Durgapur (with British collaboration), Rourkela (with West German collaboration), Bhilai and Bokaro (both with Russian collaboration). The Bokaro factory is capable of producing 4 million tons of steel ingots by 1976 and will have an eventual capacity of 10 million tons of steel ingots. As of 1975, however, the total capacity of all Indian steel mills was 12 million tons of ingots.

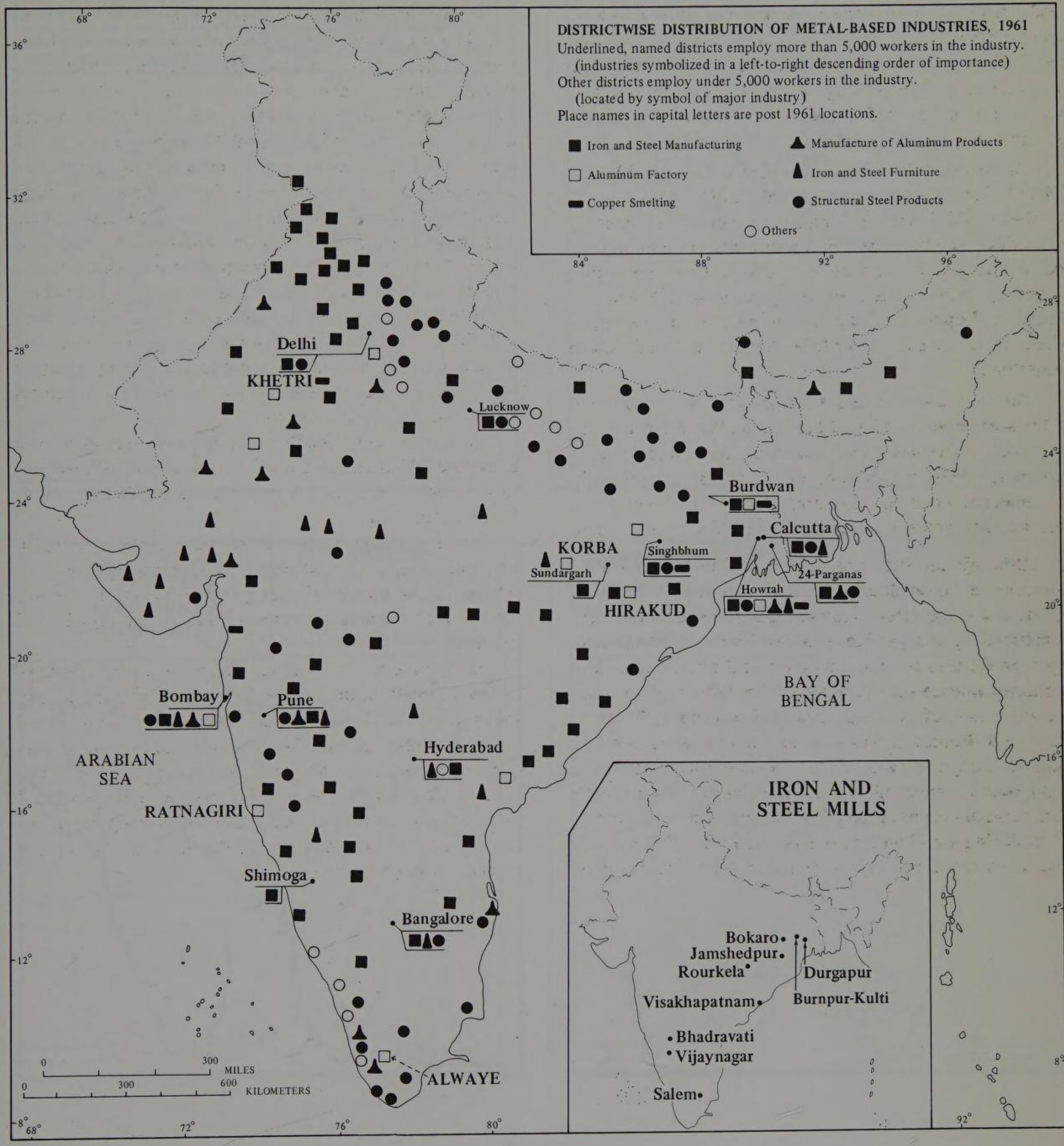
Three new small-scale steel plants in south India (Visakhapatnam, Vijaynagar, and Salem) are central government projects and will primarily serve south Indian demands. Though these south Indian mills will ease the regional imbalance in steel production to some extent, the overall location of steel mills in the country remains concentrated in the areas of ore deposits. Though substantial compensations have been made during the past twenty-eight years, in terms of balancing steel mill locations even reasonable balancing of location will probably never be achieved. The geographical advantage of raw material location will continue to be an overriding factor in the future.

While Bombay has developed significant production capacity for structural steel products, steel furniture, and the manufacture of other steel products primarily based on Bhilai and Bhadravati steel ingots, the principal locational factor remains regional demand.

Bhadravati steel ingots serve the demands of nearby Bangalore which has developed into an important metallurgical center where the famous Hindustan Machine Tools Factory is located.

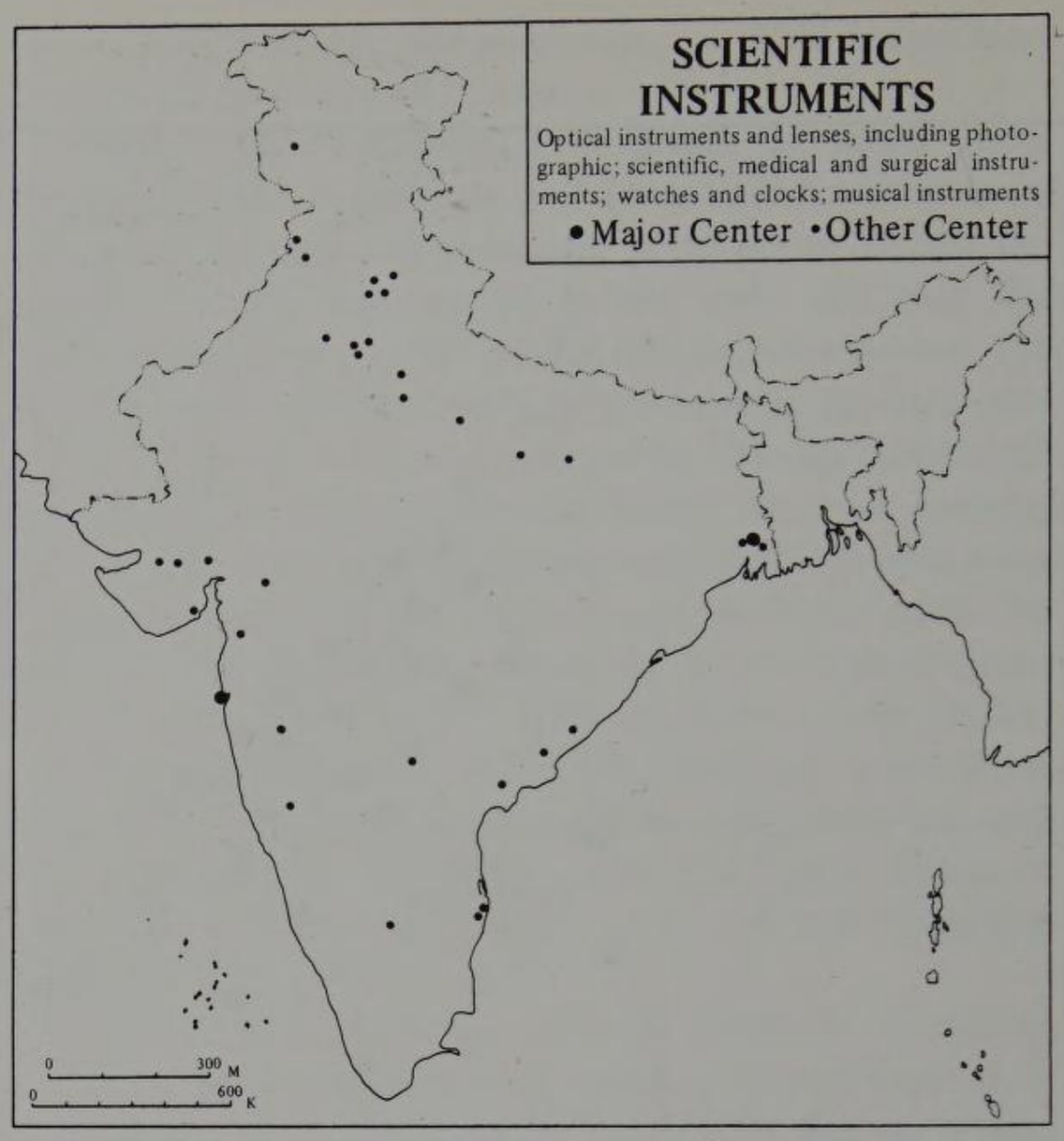
Small-scale, decentralized steel manufacturing based on iron and steel from distantly located steel mills has developed in the Punjab, Haryana, and Delhi regions. Delhi's market attracts a large concentration of structural steel products.

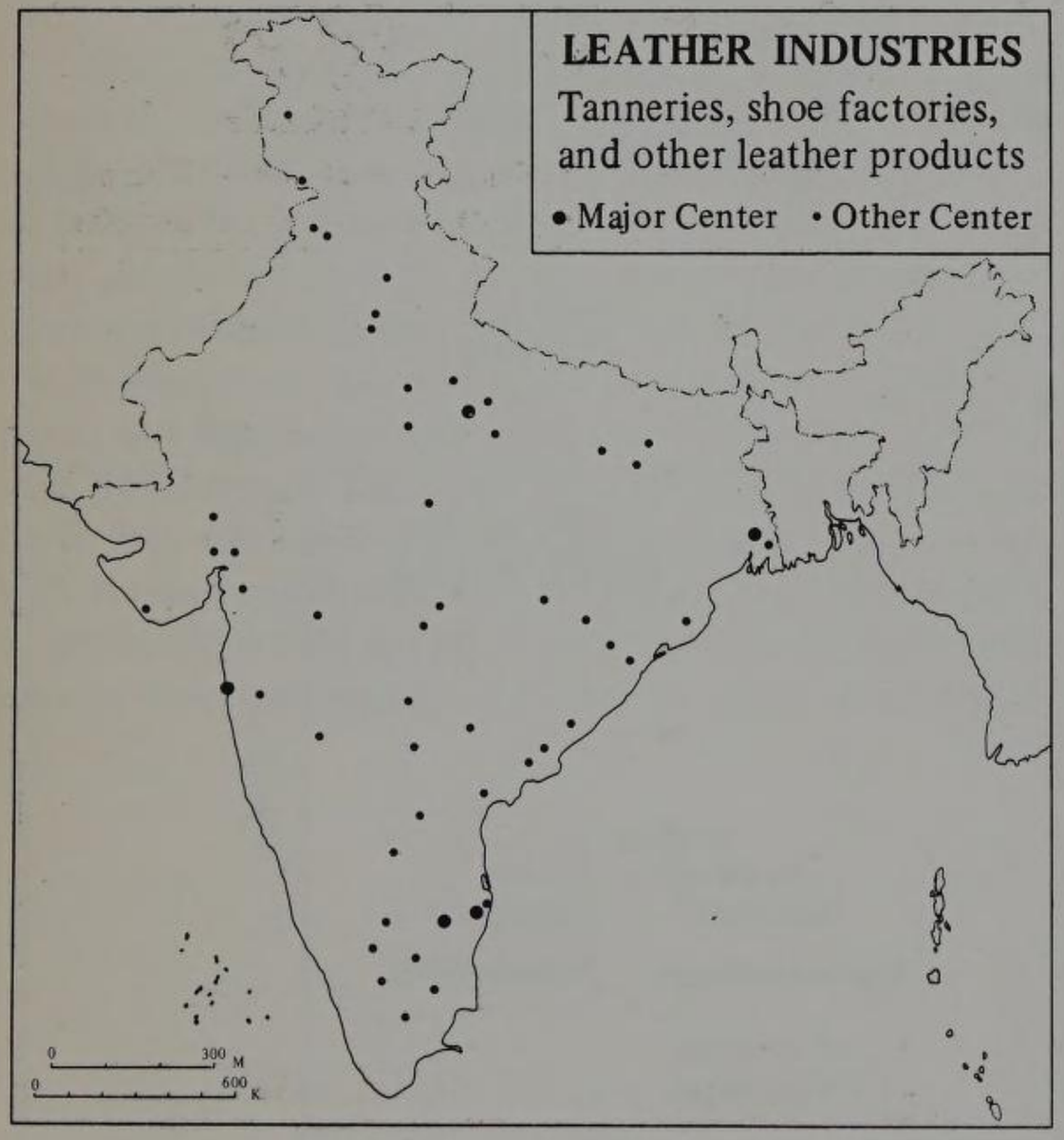
During the past several years additional problems have retarded growth in production in the steel industry, among which are the underutilization of steel mill capacity, a coal supply problem, an insufficient power supply, and inadequate transportation linkages. Unless sufficient effort is put forth by the responsible agencies to solve these problems, India will not be able to meet its domestic production target of 10 million tons by 1978-79, even though the capacity of the steel mills is higher.

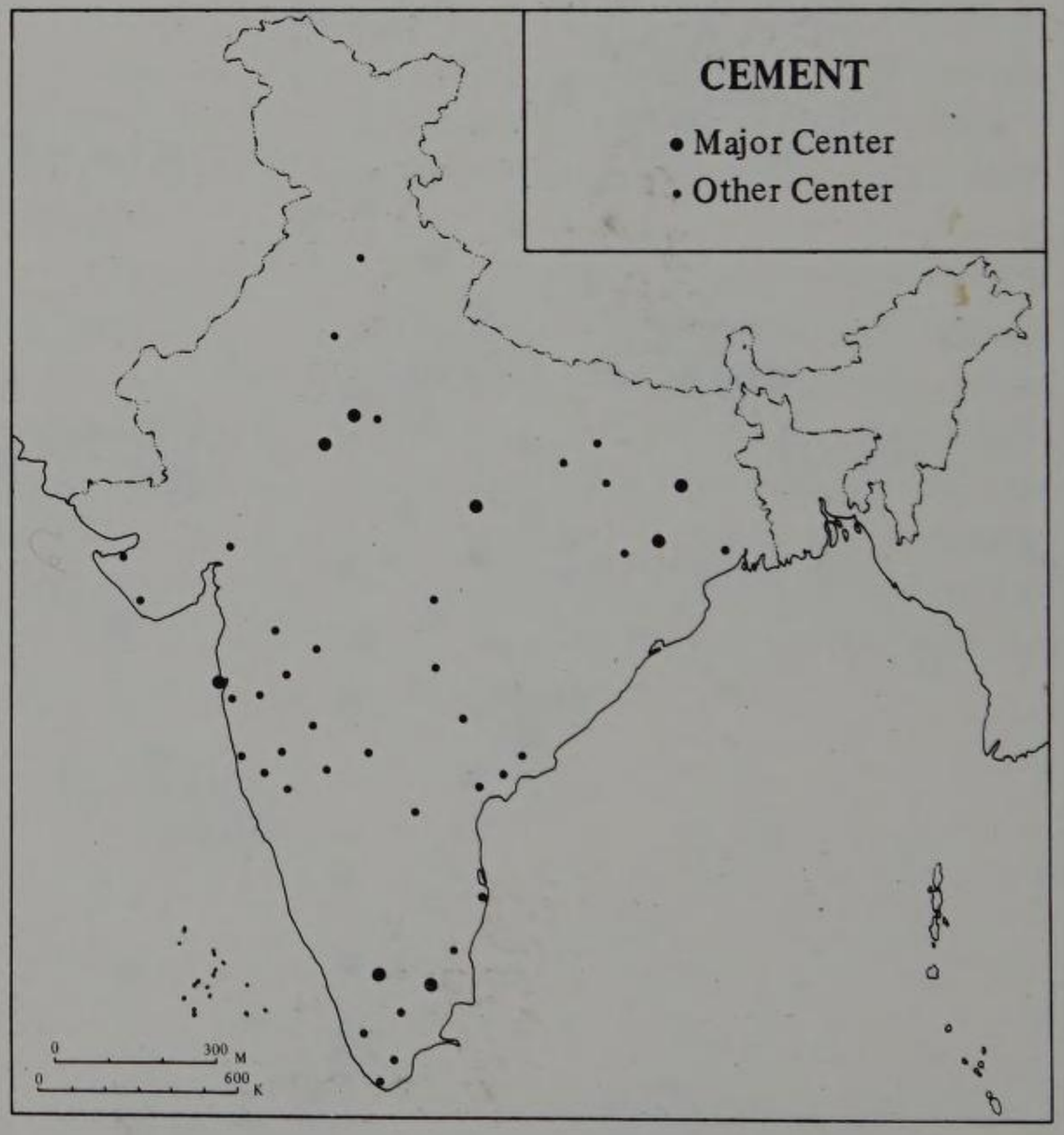

DISTRICTWISE DISTRIBUTION OF METAL-BASED INDUSTRIES, 1961
Underlined, named districts employ more than 5,000 workers in the industry.
(industries symbolized in a left-to-right descending order of importance)
Other districts employ under 5,000 workers in the industry.
(located by symbol of major industry)
Place names in capital letters are post 1961 locations.
Iron and Steel Manufacturing
Aluminum Factory
Copper Smelting
Manufacture of Aluminum Products
Iron and Steel Furniture
Structural Steel Products
Others
Delhi
KHETRI
Lucknow
Burdwan
Calcutta
KORBA
Sundargarh
Singhbhum
24-Parganas
Howrah
HIRAKUD
Bombay
Pune
Hyderabad
ARABIAN SEA
BAY OF BENGAL
RATNAGIRI
Shimoga
Bangalore
ALWAYE
IRON AND STEEL MILLS
Bokaro
Jamshedpur
Rourkela
Durgapur
Visakhapatnam
Burnpur-Kulti
Bhadravati
Vijaynagar
Salem
0 300 MILES
0 300 600 KILOMETERS

# DISTRICTWISE DISTRIBUTION OF SELECTED INDUSTRIES

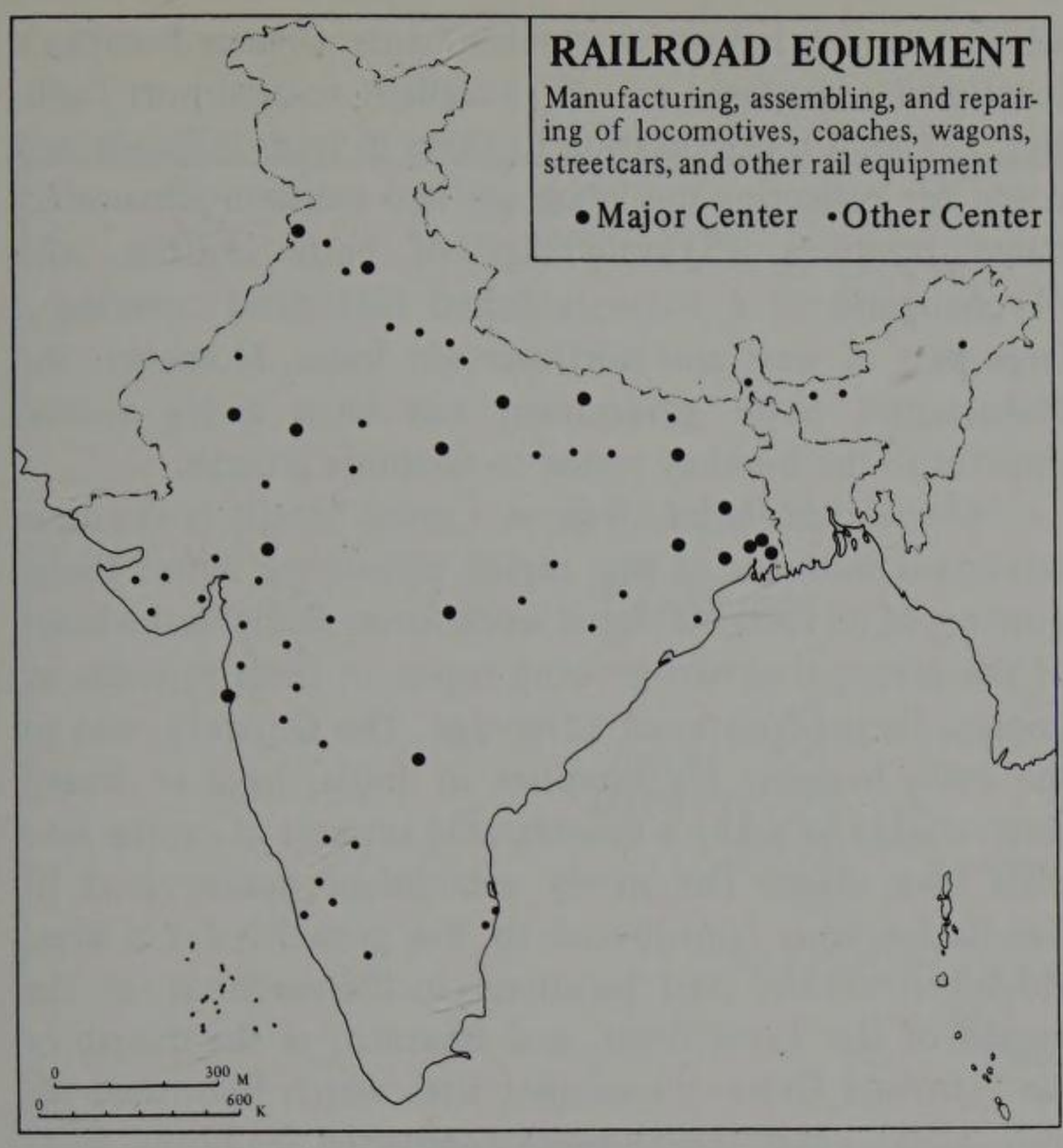
ENGINEERING EQUIPMENT
Heavy machines and tools, motors, generators, electrical equipment, cables, transmitters, radios, microphones, and machines other than electrical
• Major Center • Other Center
0 300 M
0 600 K

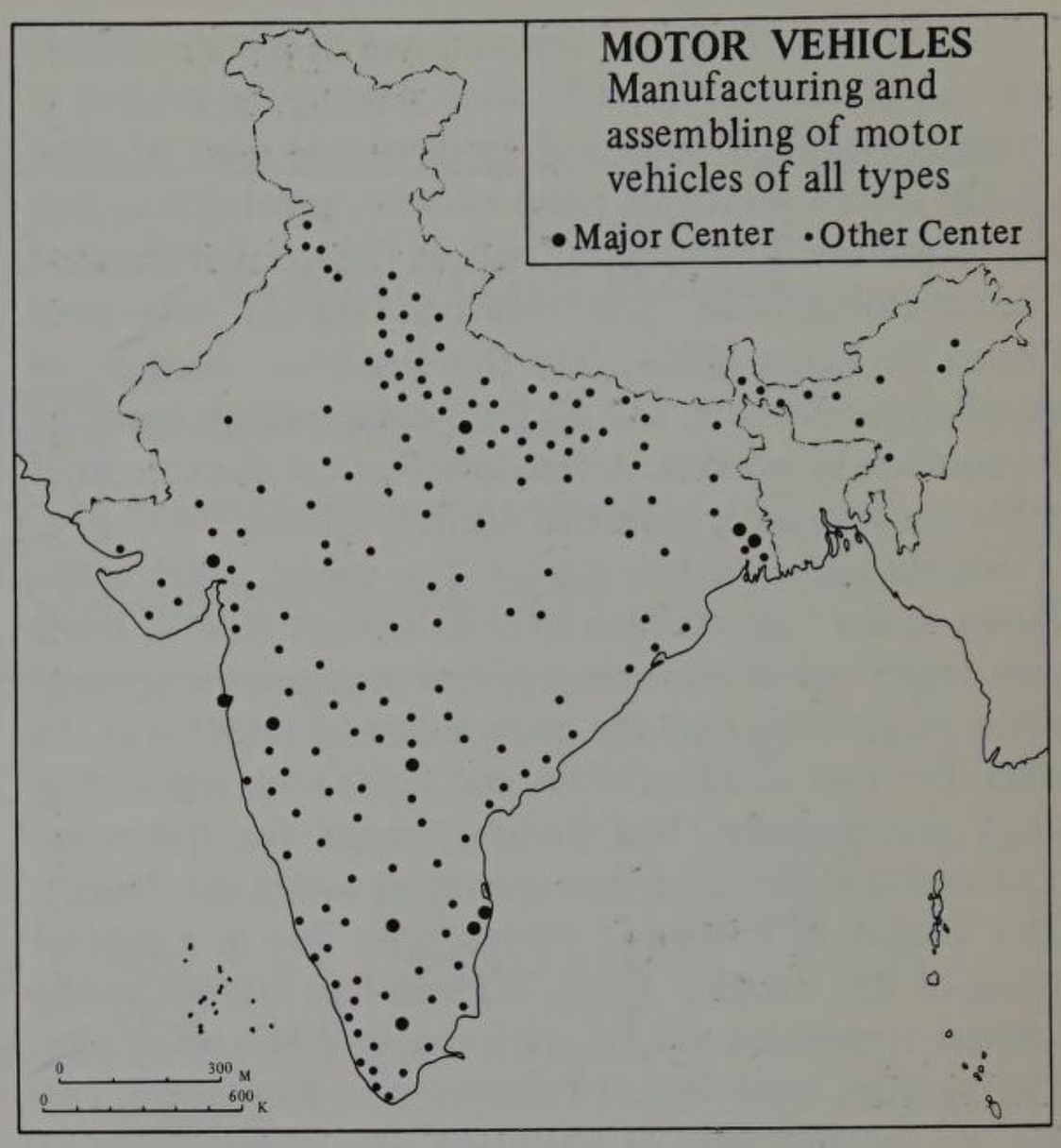

SCIENTIFIC INSTRUMENTS
Optical instruments and lenses, including photographic; scientific, medical and surgical instruments; watches and clocks; musical instruments
• Major Center • Other Center
0 300 M
0 600 K

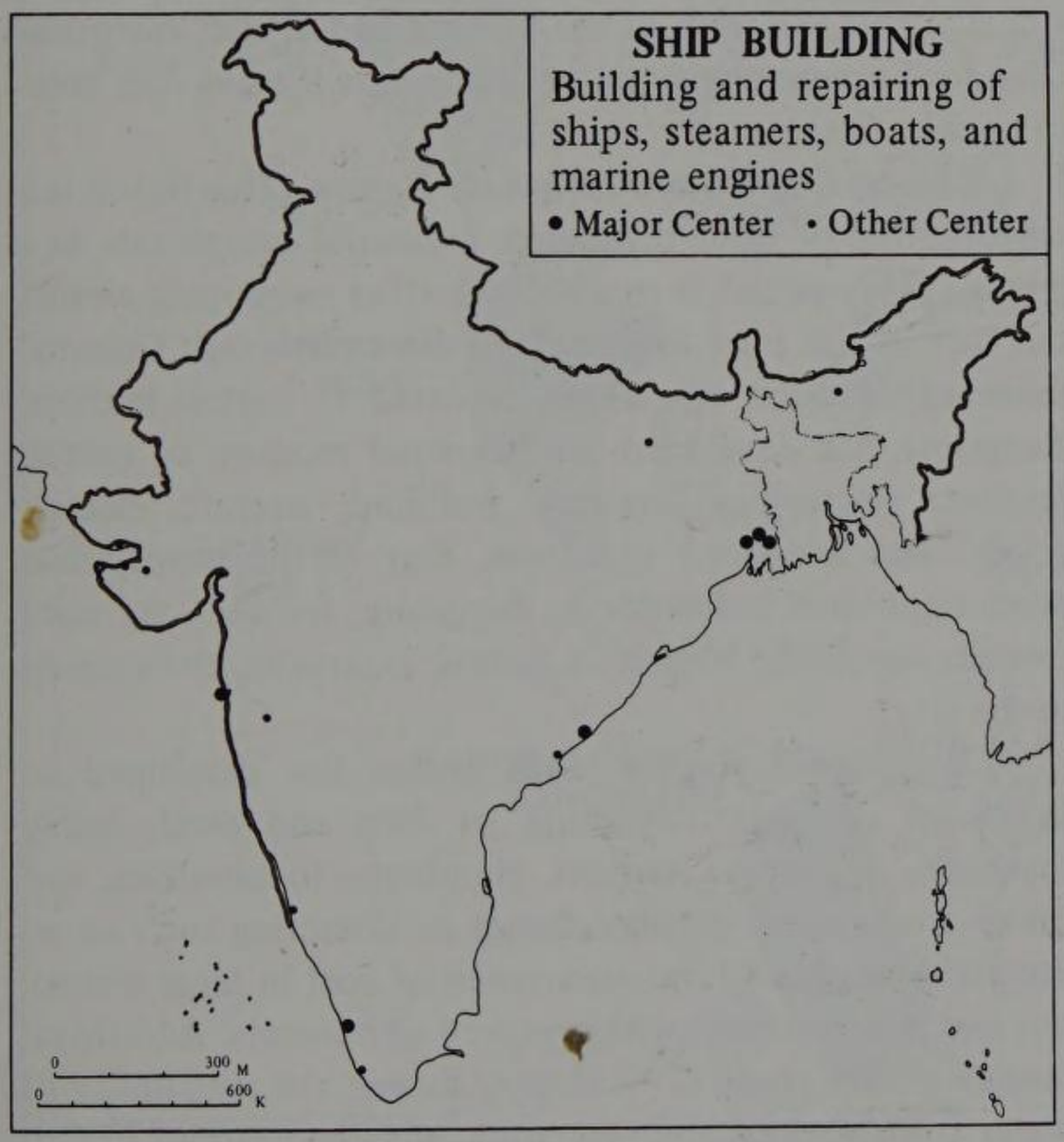


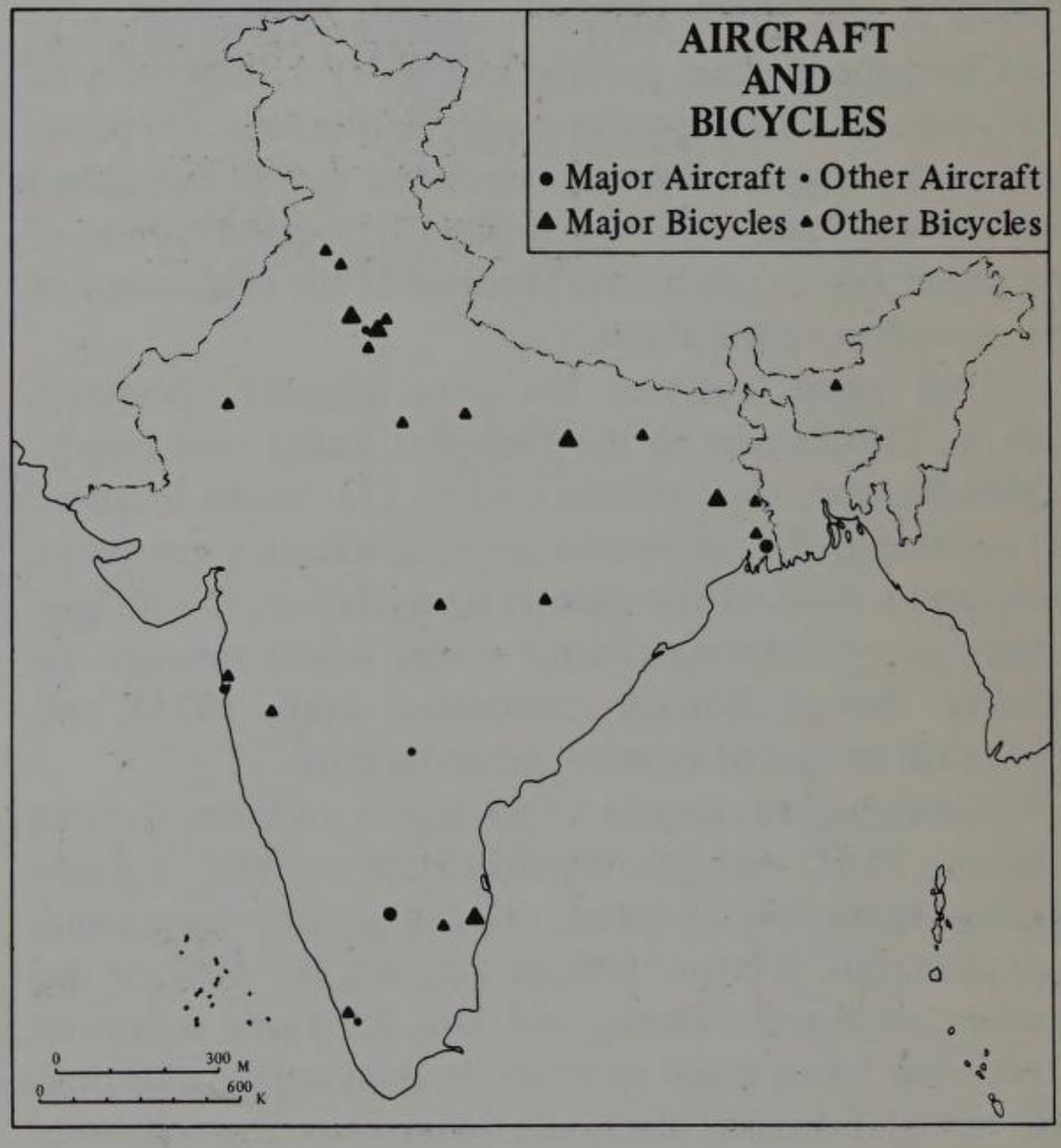



## DISTRICTWISE DISTRIBUTION OF TRANSPORT EQUIPMENT INDUSTRIES


RAILROAD EQUIPMENT
Manufacturing, assembling, and repairing of locomotives, coaches, wagons, streetcars, and other rail equipment
• Major Center • Other Center
0 300 M
0 600 K





SHIP BUILDING
Building and repairing of ships, steamers, boats, and marine engines
• Major Center • Other Center
0 300 M
0 600 K



## MANUFACTURING REGIONS

Industries in India are concentrated in specific regions based on the economics of location. During the process of industrial evolution, some regions developed more advantageously from a locational point of view, growing into clusters of industrial complexes, such as Greater Bombay and Calcutta-Hooghlyside. The industrial regions have been divided by Karan (1964) into five first-order districts, 14 second-order districts, and 12 third-order districts based on the numbers of workers. A description of the characteristics of the five first-order industrial districts follows.

*Calcutta-Hooghlyside Region.* This region, which is also known as the Calcutta Metropolitan District (CMD), is the most important in the country. Jute processing and metal works (engineering) are the main industrial activities of the CMD. For two decades (1950s and 1960s) this region stagnated economically. The primary causes for this were: (1) congestion of surface transportation within this district; (2) a decline in Calcutta's port activity due to a gradual silting of the Hooghly River; (3) hardships created by the political imposition of the partition in 1947 when jute-growing areas went to East Pakistan, now Bangladesh, cutting off the very base of Calcutta's jute mills in terms of raw material supply (which difficulty was partly circumscribed in the 1950s by encouraging jute production in West Bengal and other parts of India); (4) undercapacity of city services including water supply and sewage; (5) political anarchy created by extreme leftist groups (*naxalites*) between 1967 and 1972; and finally (6) frequent failures of the power supply (electricity) because of the inadequacy of the power-generating plants.

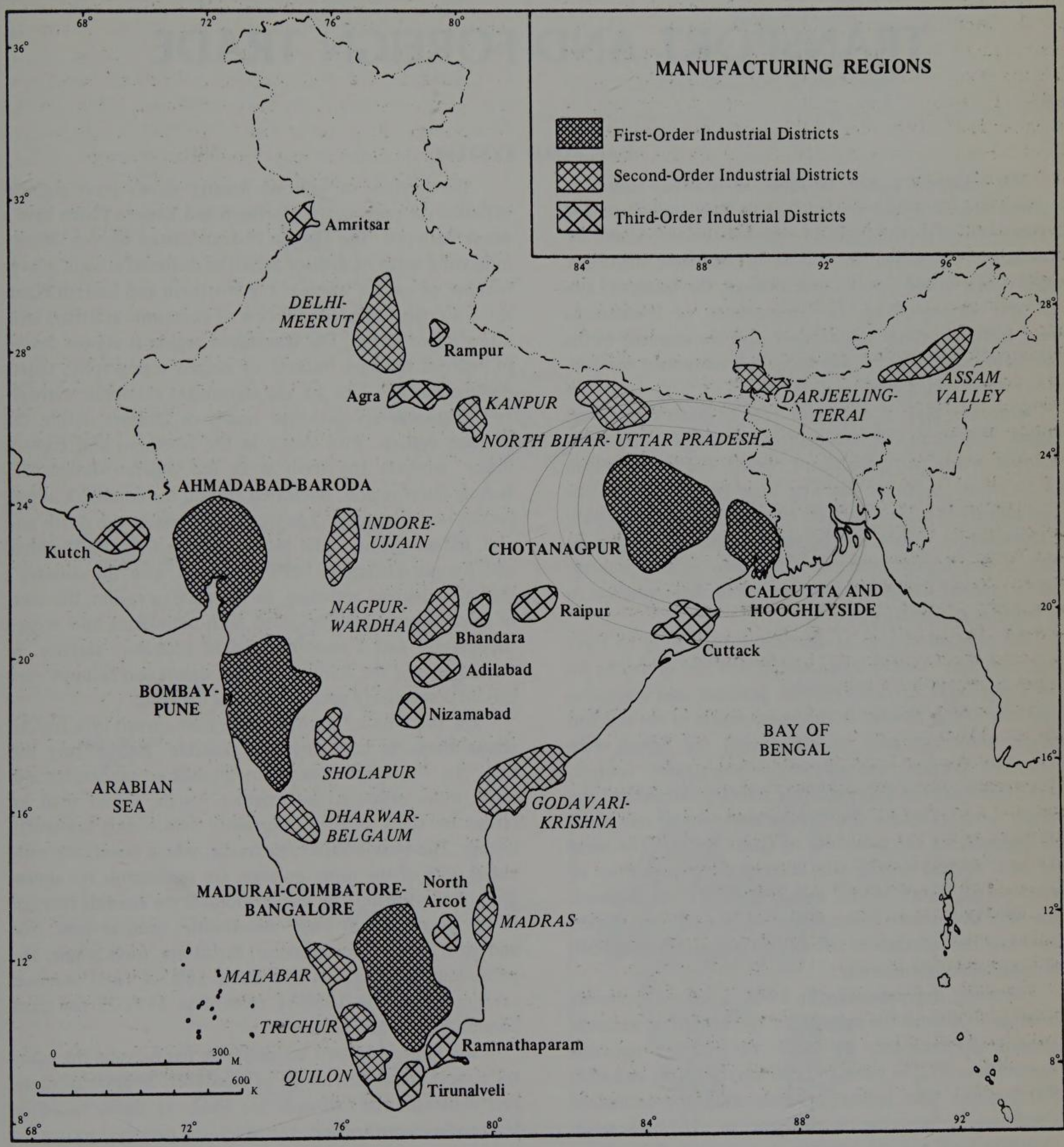
This region, however, has some inherent advantages such as: (1) nearness to the Damodar Valley coal supply, (2) Chotanagpur steel-making centers, (3) riverine location, (4) command of a hinterland covering almost a quarter of India and a third of the country's population, (5) the possibility of rejuvenating riverine routes inland through the Farakka Barrage Scheme (completed April, 1975), and (6) the advantages of an early industrial start.

*Bombay-Pune Region.* This region includes Greater Bombay, Pune, and the Bombay-Pune corridor. Greater Bombay specializes in cotton textiles, general engineering, and chemicals. Cotton textiles account for 40% of the workers employed. During the last 25 years, industrial growth has taken place primarily in chemical, engineering, and capital intensive electronic industries. The 120 mile corridor between Pune and Bombay is developing rapidly with numerous industrial establishments. Greater Bombay's locational advantages are: (1) excellent natural port facilities, (2) good transportation linkages in both railroads and roads for collecting raw materials and marketing manufactured products, (3) availability of basic utilities, and (4) command of a well-established hinterland covering a large part of west and northwestern India. Moreover, the Maharashtra State government has been giving special impetus to the Bombay region to facilitate growth.

*Ahmadabad-Baroda Region.* Cotton textile is the most important industry of this region employing about three-quarters of its total industrial work force. Being in the heart of the principal cotton-growing region in India provides an unprecedented locational advantage. The Gujaratis, one of the main business communities of India, have in recent times started to pump a considerable amount of capital into their own state. The newly established nearby port of Kandla has also contributed to the growth of the area. Moreover, several port locations–including Surat, at the mouth of the Tapti River, and Bharuch, at the mouth of the Narmada River–are ancient sites which flourished for over 1,500 years. These ports conducted sea-borne trade with East and Southeast Asia and the Middle East. Traditionally, this area falls at the oceanic end of the "historical corridor" originating from the Delhi-Agra-Kanauj core areas of ancient times.

*Madurai-Coimbatore-Bangalore Region.* This region is a combination of three distinctive industrial complexes. As a whole, they specialize in cotton textiles employing almost one-half of the total industrial workers. Although Coimbatore and Madurai are largely oriented to cotton textiles, Bangalore has developed an industrial mixture of cotton textiles, electronics, machine building, aircraft, electric goods, and telephone industries. Out of the twenty-four most important industries in Bangalore, fourteen are state owned, signifying large-scale public enterprise investments in the city.

*Chotanagpur Region.* This region has developed an industrial complex consisting of iron and steel, heavy machines, explosives, cement, aluminum, locomotives, and diesel trucks. The primary factor in attracting such an industrial complex is the occurrence of coal in large quantities and in association with a variety of minerals. Additional factors are the cheap DVC electric power, the availability of water from streams and reservoirs, and the nearness of Calcutta's market and port.


MANUFACTURING REGIONS
First-Order Industrial Districts
Second-Order Industrial Districts
Third-Order Industrial Districts
Amritsar
DELHI-MEERUT
Rampur
Agra
KANPUR
NORTH BIHAR- UTTAR PRADESH
DARJEELING-TERAI
ASSAM VALLEY
AHMADABAD-BARODA
Kutch
INDORE-UJJAIN
CHOTANAGPUR
CALCUTTA AND HOOGHLYSIDE
NAGPUR-WARDHA
Raipur
Bhandara
Adilabad
Nizamabad
Cuttack
BOMBAY-PUNE
SHOLAPUR
ARABIAN SEA
BAY OF BENGAL
DHARWAR-BELGAUM
GODAVARI-KRISHNA
MADURAI-COIMBATORE-BANGALORE
North Arcot
MADRAS
MALABAR
TRICHUR
Ramnathaparam
QUILON
Tirunalveli
0 300 M.
0 600 K
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

# Chapter 6

# TRANSPORT AND FOREIGN TRADE

## RAILROAD SYSTEM

The transport system in India, as in other countries, provides the essential infrastructure to serve agriculture and industry and also to stimulate regional socioeconomic development. Consisting as it does of railroads, highways, inland water routes, ports, and airways, the transport system was developed as the consequence of investments which have long-range implications and are essential to the successful completion of any type of development the public or private sector initiates.

Railroads play a dominant role in India's transport system. This point, well recognized by the government, is reflected in the fact that about 50% of the investment in the transport sector of the Five-Year Plan (1974-79) has been allocated to the railroads. The railroad system, a public undertaking, owned and operated by the central government, is the largest nationalized complex in the country. India's railroad network is the largest in Asia, whereas in the world it ranks fourth.

The railroad system as developed from 1853 to 1947 (approximately 31,050 miles or 50,000 km of tracks by 1947) was built to facilitate the political and economic endeavors of the British. With the extension of the railroad system, which operated on Indian coal, the British were guaranteed (a) swift and efficient administrative control, (b) the movement of police and the military throughout the country, and (c) access to ports for shipment of raw materials destined for the industries of Great Britain. The same port and railroad system also allowed the distribution of manufactured goods which were received from England. Thus did the massive development of the railroad system perpetuate the strength of the British colonial system both politically and economically.

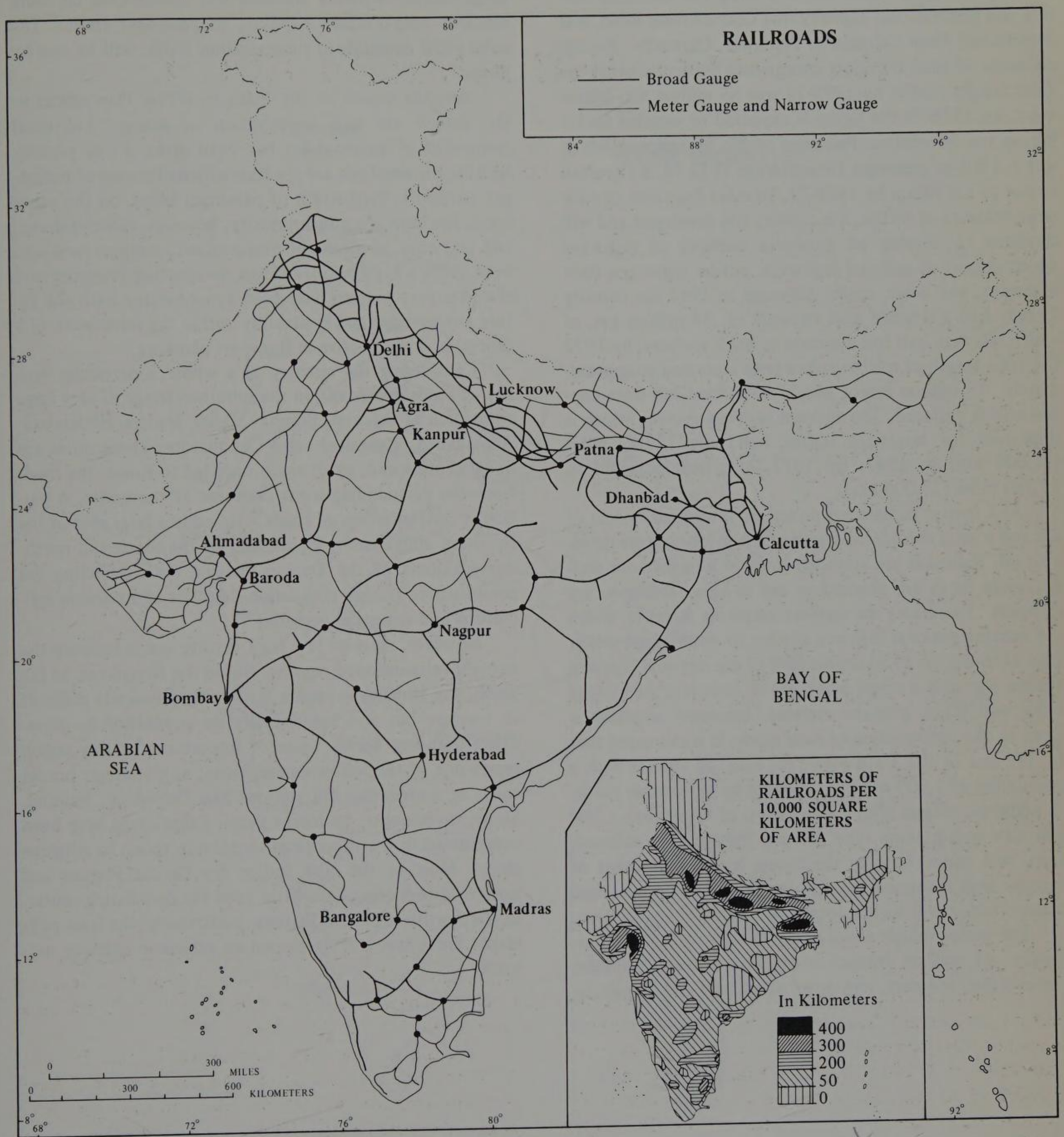
Following independence in 1947, constant endeavor was made to extend the system for the benefit of national economic development. By 1973, the railroad network extended over 37,284 miles (60,000 km) of tracks and with 7,000 stations. The system operates daily approximately 10,800 trains covering a distance of 745,680 miles (1,200,000 km). On the average, it transports 7.3 million passengers and .55 million tons of freight each day.

The pattern of railroad density shows great regional variation. In general, the Northern and Eastern Plains have a dense network. The Deccan Plateau has an uneven density indicating areas of greater activities centered around a large number of nuclei, whereas the Northern and Eastern Plains show a rather even distribution of economic activities with a few major nodes. The Himalayan region is almost devoid of railroad linkages because of rugged topography, sparse population, and lack of any significant economic activity.

There are six principal nodes or clusters within the railroad system. Five occur in the Northern and Eastern Plains, whereas the sixth is in the Gujarat-Ahmadabad-Baroda-Surat region, nucleated around the country's largest cotton-textile center. Among the centers in the north and east Indian plains, most prominent are Calcutta-Dhanbad and Kanpur-Lucknow, both associated with the country's leading industrial activities. In the plateau region, the areas of least density are associated with undulating and rugged topography and a minimal level of economic activity. In Rajasthan and the Rann of Kutch, desert and swampy conditions respectively account for low density.

On the whole, railroads have now spread into regions where they are necessary and possible. Recognizing this fact, the Fifth Five-Year Plan intends to modernize and make more efficient the existing system rather than increase its track mileage. Currently two trends are worth noting. The busy arterial rail tracks, which constitute only about 25% of the route mileage, are responsible for almost 75% of the traffic. The second trend is the sizeable increase in the movement of bulk commodities such as coal, iron and steel, ores, stone, cement, fertilizers, food grains, and petroleum products. A rise from 58% of total revenue-earning tonnage in 1950-51 to 80% in 1971-72 for those commodities is indicated.

The railroad system undoubtedly has become the country's most important mode of transport. In spite of diesel fuel shortage, the railroads are likely to thrive based on large-scale electrification, for which the principal sources of energy (coal and water power) are available in adequate amounts within the country.


RAILROADS
Broad Gauge
Meter Gauge and Narrow Gauge
Delhi
Lucknow
Agra
Kanpur
Patna
Dhanbad
Calcutta
Ahmadabad
Baroda
Nagpur
Bombay
Hyderabad
Bangalore
Madras
ARABIAN SEA
BAY OF BENGAL
KILOMETERS OF RAILROADS PER 10,000 SQUARE KILOMETERS OF AREA
In Kilometers
400
300
200
50
0
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
8°
12°
16°
20°
24°
28°
32°

## ROAD TRANSPORT

Road transportation, an important mode in modern India, has long historical roots. During the sixteenth century the first national highway, the Grand Trunk Road, was constructed from Calcutta to Peshawar. Currently, the significance of road transport is expressed by the fact that the total freight traffic by 1973-74 was 65 million ton kilometers; by 1978-79 the figure is expected to increase to 1.1 billion ton kilometers. Passenger traffic by highway which was 1.3 billion passenger kilometers in 1973-74, is expected to rise to 1.8 billion by 1978-79. To meet the needs of such large volumes of traffic, the country has developed and will continue to develop an extensive network of highways which consist of national highways, border highways, state highways, and other roads. Although in 1947 the country already had a sizeable road network of .38 million km, of which less than half had concrete or brick surfaces, by 1972 the total length of roadways had been increased to approximately .75 million km of which .43 million km were concrete-brick surfaced. The national highway system, which is important for interstate traffic, had only 13,049 miles (21,000 km) in 1947; by 1972-73 it had increased to 17,399 miles (28,000 km).

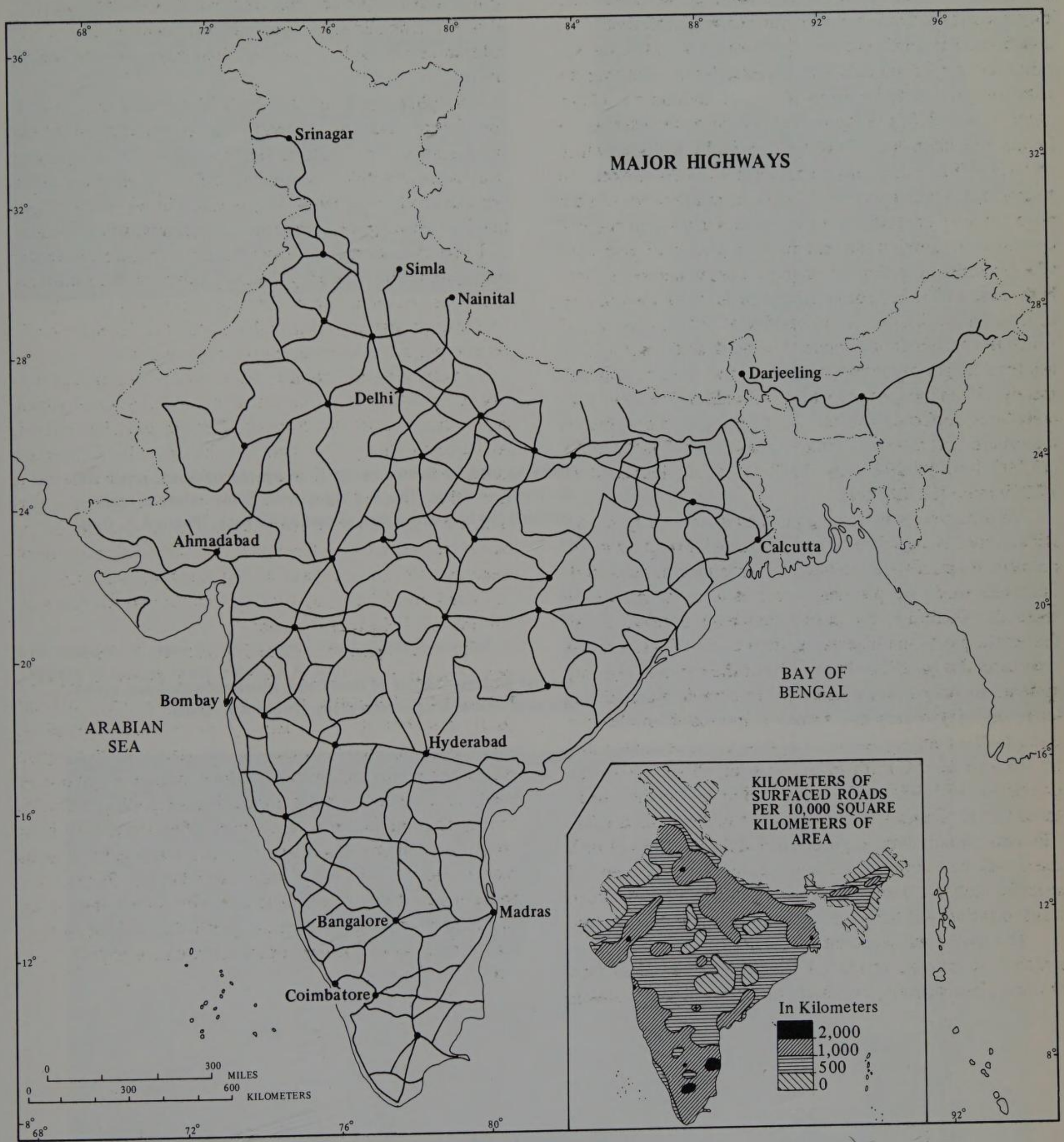
As a matter of national policy, an integrated system of rail and road is considered a part of the infrastructure development. Railroads are intended to serve long-distance traffic, while roads are planned to act as local feeders to the railroads. Therefore, the current emphasis is (a) to widen the existing national highway system to double-lane rather than extend it (in 1970 almost 80% of the national highway system was only a single lane); (b) to complete the missing links; and (c) to improve surfaces. Increased emphasis is given to the construction of rural roads. It is estimated that by the end of the Fifth Five-Year Plan, all villages with a population of 1,500 will be connected by all-weather roads. In addition, villages with a population of fewer than 1,500 will also obtain some type of road linkage. The railroad, then, will concentrate in the future in the movement of specific bulk commodities for long distances, while road transportation will handle local collection and distribution.

The motor vehicle count at present consists of approximately .41 million trucks; .11 million buses; .5 million motorcycles, scooters, and auto rickshaws; and .7 million automobiles. Buses will accommodate short-distance passenger traffic whereas railroads will concentrate on more efficient long-distance handling of passenger traffic. The substantial demands of metropolitan traffic will be met by buses.

Another aspect of the Fifth Five-Year Plan relates to the future use and conservation of energy. Individual ownership of automobiles has been given a low priority because automobiles are the least efficient means of passenger transport. Production of passenger buses, on the other hand, has been given high priority. Scooters, autorickshaws, and taxi cabs, as means of personalized transport have also been given a high priority. Thus, production priorities and the transport pattern have been synchronized with the future energy costs and availability within the framework of a general policy objective in transport planning.

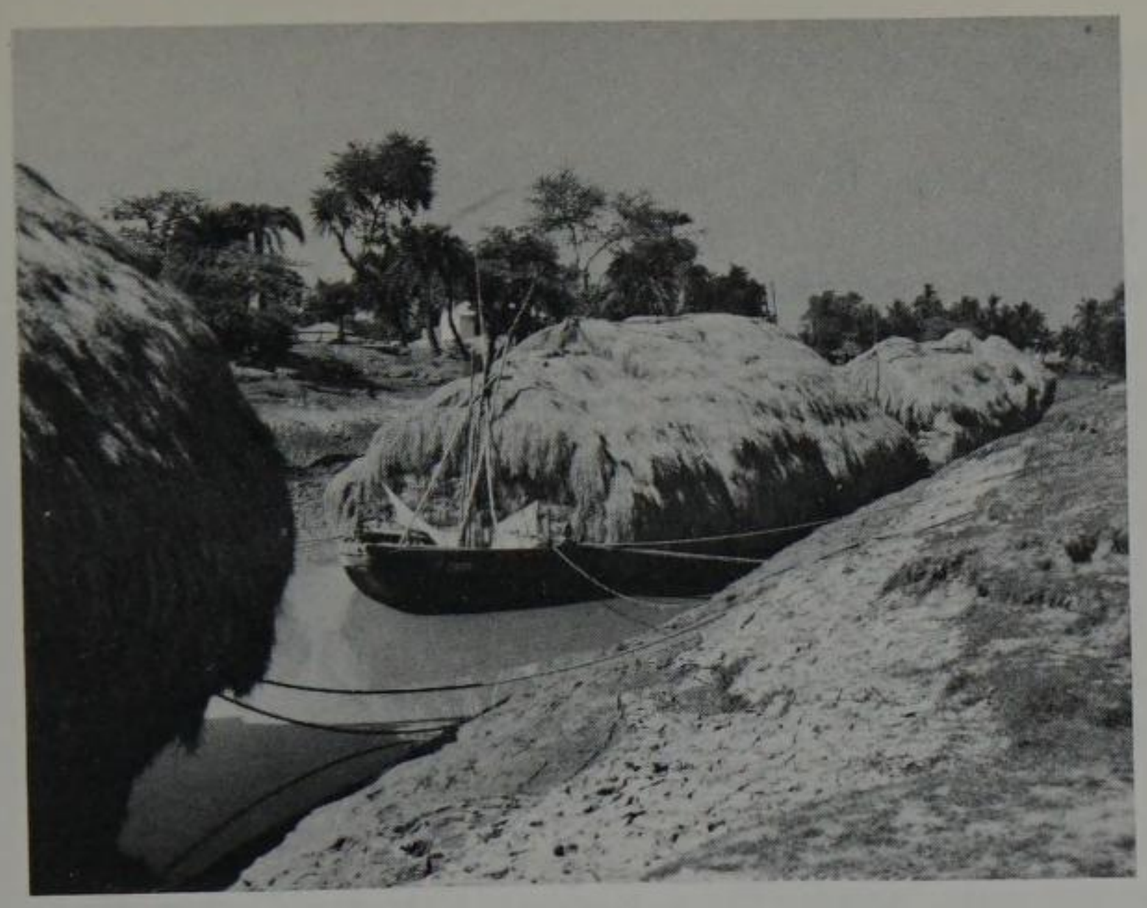
Considering the country as a whole, a particular density of roads occurs within the suburban fringe of very large cities such as Calcutta, Bombay, Delhi, Madras, Hyderabad, Ahmadabad, Bangalore, and Coimbatore. These cities are nodal centers and, as all roads once led to Rome, the roads from the surrounding areas converge at the nodes. A particular concentration of roads is found in a large area of the Northern and Eastern Plains, and in the south and northwestern parts of the Deccan Plateau, both reflecting the combination of high population densities and sizeable agricultural and industrial activities.

However, areas of low road density occur between the two above mentioned regions, and in the Himalayas. In the north, the Himalayan region is not only physically difficult to traverse but also has virtually no population to serve. Therefore, any access route of importance in this region serves one of the following functions: as a strategic border road, or connecting hill stations like Darjeeling, Nainital, Simla, or Srinagar. In recent years, a few roads have been constructed in the mountains to provide access to religious places. Most of the hilly and/or dry Deccan Plateau and western desert areas have little need for connecting routes. In the northern Deccan Plateau, particularly, the least populated areas have not developed an extensive highway network.


MAJOR HIGHWAYS
Srinagar
Simla
Nainital
Delhi
Darjeeling
Ahmadabad
Calcutta
Bombay
ARABIAN SEA
Hyderabad
BAY OF BENGAL
Bangalore
Madras
Coimbatore
0 300 MILES
0 300 600 KILOMETERS
KILOMETERS OF SURFACED ROADS PER 10,000 SQUARE KILOMETERS OF AREA
In Kilometers
2,000
1,000
500
0
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

Carrying load by human beings is an age-old tradition, which still continues in India. This is a scene from Simla, where a coolie is climbing the hills with a sack of coal on his back. (Photo A.K. Dutt)

Central Business District of New Delhi, where autorickshaws, cycles and automobiles are common scene. (Photo A.K. Dutt)



Canals are used not only for irrigation or drainage, but also for transport of commodities. In this scene loads of hay are being carried. (Photo Jibananda Chatterje)

An ocean-going vessel on the Hooghly River stands in contrast to a number of country boats. (Photo A.K. Dutt)

A typical passenger-carrying rowing boat; small size. (Photo A.K. Dutt)

## AIRWAYS, INLAND WATERWAYS AND PORTS

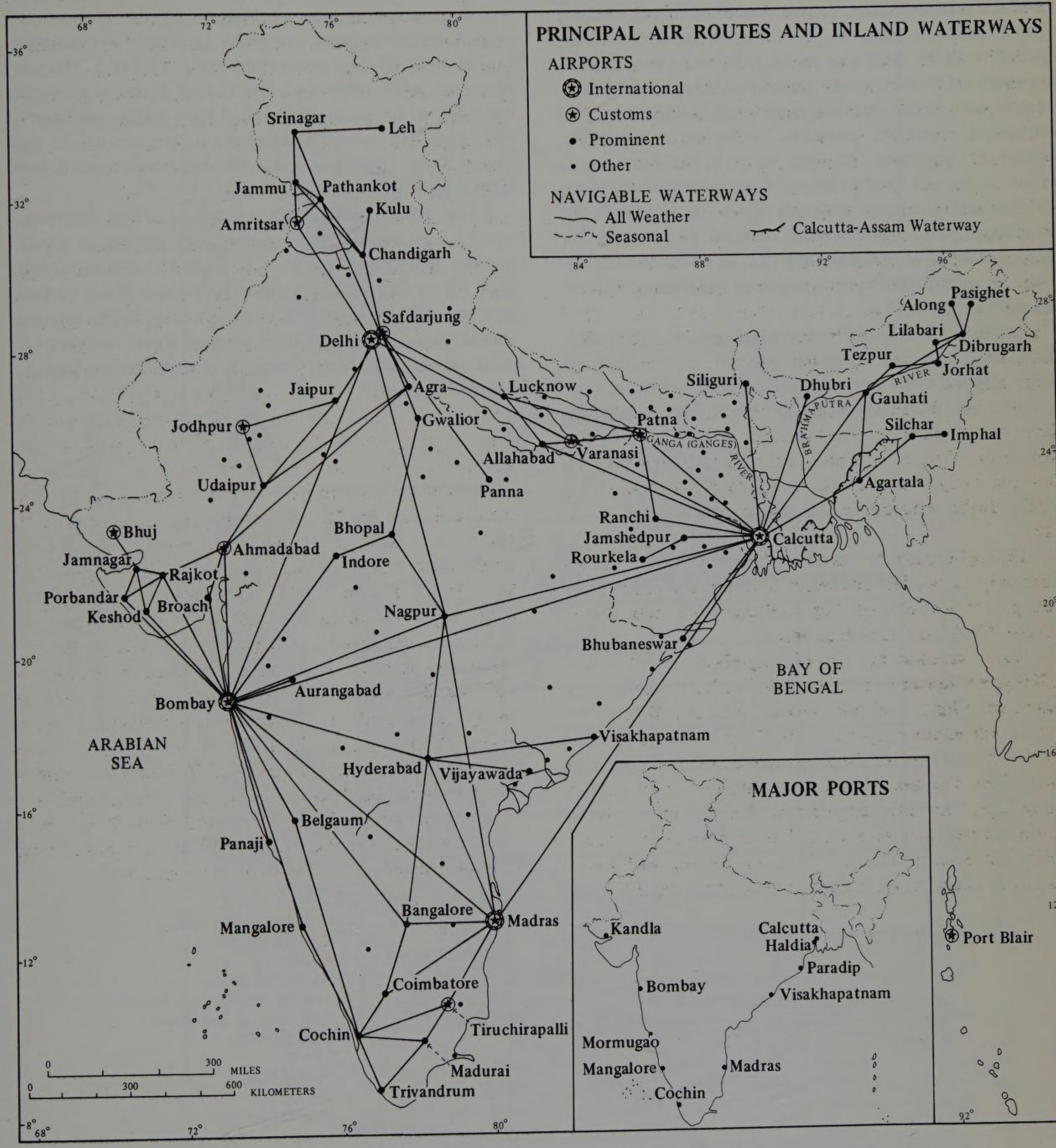
Air transport in India, as in most other nations, has developed significantly since the Second World War. For example, Indian Airlines flew 3.7 million miles (6 million km) in 1971 compared to 1.2 million miles (2 million km) in 1947. Air transport accounts for passenger as well as cargo traffic within the country. Civil aviation for scheduled flights is state owned. The Department of Civil Aviation operates the civil airports. The four international airports (Delhi, Calcutta, Bombay, and Madras) have been managed by the International Airports Authority since 1972. Two agencies manage the operation of flights: Air India for international flights, and Indian Airlines for national flights with connections also to Nepal and Bangladesh. In addition to the four international airports, there are nine other customs airports: Ahmadabad, Patna, Delhi (Safdarjung), Tiruchirapalli, Varanasi, Jodphur, Bhuj, Port Blair, and Amritsar. Altogether there are 85 working airfields in India.

As might be expected, the Ganges Plain, with its high density of population, has the largest number of airfields. Not all the airfields are regularly used for scheduled flights, however. Only important cities and tourist locations have regular flight connections; others are used only occasionally.

Flying in India is a luxury which few people can afford; only a few select business people, professional individuals, government officials, top politicians, and foreign tourists are able to take advantage of it.

Water transport has played a significant role for over 2,000 years; Indian merchants traded with Southeast Asian countries, China, and the ancient Romans. Within the nation, inland shipping was particularly well developed in the north where perennial rivers make navigation possible throughout the year. In southern India, because of the many rapids and the nonperennial character of the rivers, stream transport never extended much beyond the deltaic areas. British occupation of the Ganges Delta, with headquarters in Calcutta on the bank of one of the distributaries of the Ganges River, made possible the control of all north India. At that time river transport was the most efficient and convenient means of long-distance inland traffic. The introduction of railroads in 1853 caused a sharp decline in inland waterway transport. Only in the Ganges and Brahmaputra arterial river system is water transportation still significant. One important waterway system was the Calcutta-Assam network which extends through Bangladesh and the Sunderbans, but this system was closed in 1965 after the India-Pakistan War. With the creation of an independent Bangladesh in 1971, it again became operational.

Along a coastline of approximately 3,536 miles (5,690 km), India has nine major ports and 186 intermediate and minor ones. Among them, Bombay, Calcutta, Cochin, Madras, and Visakhapatnam had already attained major port status before 1947. Bombay, the largest port, handles about 25% of the nation's foreign trade. Calcutta commands the largest and richest hinterland in the country; Haldia is Calcutta's deep water subsidiary port. Visakhapatnam is the port location where the first shipbuilding yard was constructed. Cochin, which has one of the best natural harbors, completed the construction of a shipbuilding yard in collaboration with the Mitsubishi Company of Japan in 1974. Madras, serving the southeast, has an artificial harbor. Four new major ports, Kandla, Paradip, Mormugao, and Mangalore, were added after independence as part of the national plan to allocate at least one major port to every maritime state. Kandla, in Gujarat, was to compensate for the loss of Karachi and to relieve pressure on Bombay as well. Kandla became a Free Trade Zone in 1965. Paradip, in Orissa, is primarily an exporting center similar to Mormugao. Mangalore, in the state of Karnataka, has been recognized as a major port since 1974. Mormugao, originally a port for the Portuguese Colony of Goa, largely exported iron ore to Europe as it still does. It has been recognized as a major port since 1963, and in terms of total tonnage handled is the nation's second largest port.

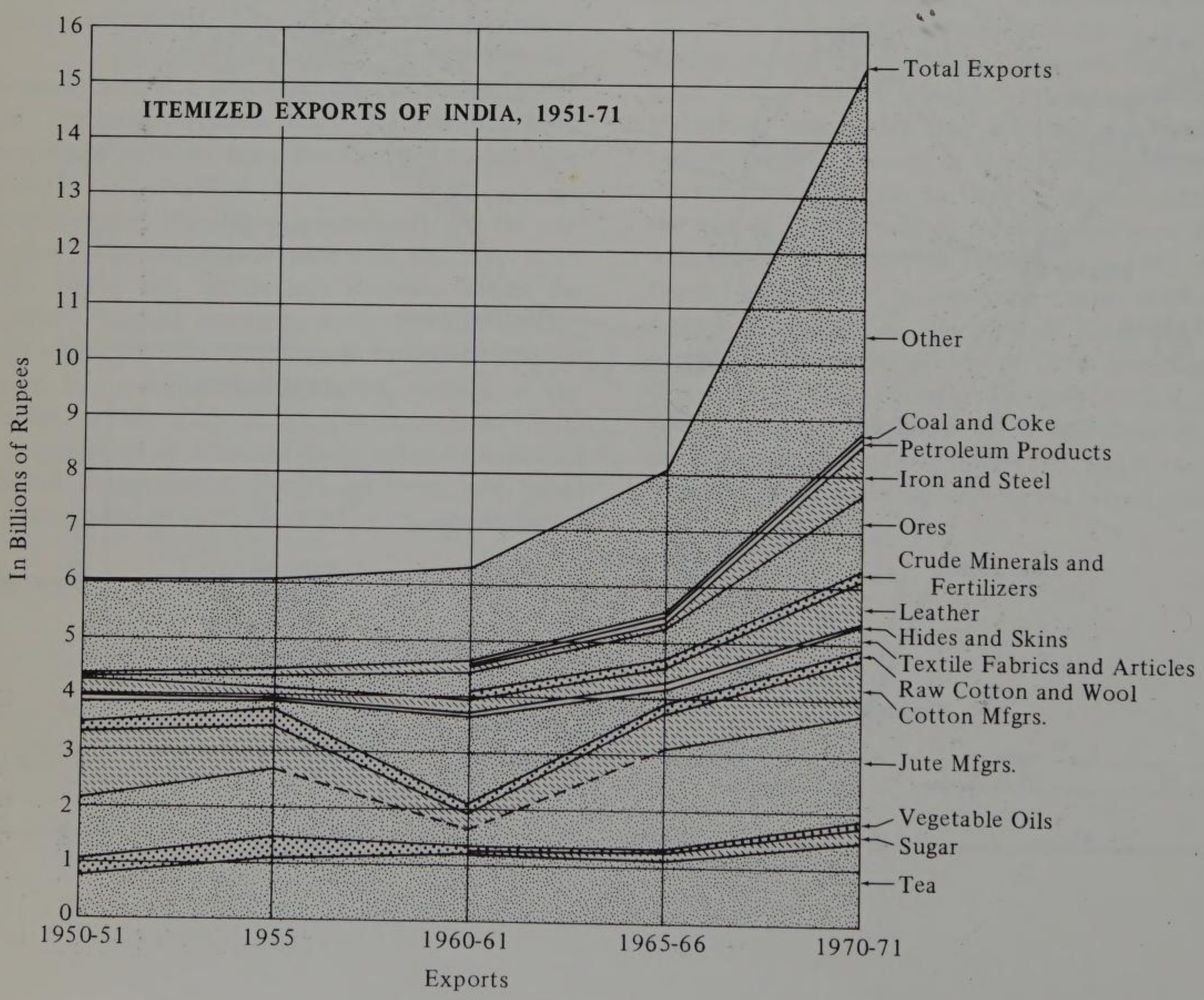

PRINCIPAL AIR ROUTES AND INLAND WATERWAYS
AIRPORTS
International
Customs
Prominent
Other
NAVIGABLE WATERWAYS
All Weather
Seasonal
Calcutta-Assam Waterway
Srinagar
Leh
Jammu
Pathankot
Kulu
Amritsar
Chandigarh
Safdarjung
Delhi
Jaipur
Agra
Lucknow
Jodhpur
Gwalior
Patna
Varanasi
Allahabad
Udaipur
Panna
Bhuj
Ahmadabad
Bhopal
Ranchi
Jamshedpur
Calcutta
Jamnagar
Indore
Rourkela
Rajkot
Porbandar
Broach
Keshod
Nagpur
Bhubaneswar
Aurangabad
Bombay
BAY OF BENGAL
ARABIAN SEA
Visakhapatnam
Hyderabad
Vijayawada
Belgaum
Panaji
Bangalore
Madras
Mangalore
Coimbatore
Cochin
Tiruchirapalli
Madurai
Trivandrum
Siliguri
Dhubri
Tezpur
Along
Pasighet
Lilabari
Dibrugarh
Jorhat
Gauhati
Silchar
Imphal
Agartala
BRAHMAPUTRA RIVER
GANGA (GANGES) RIVER
MAJOR PORTS
Kandla
Calcutta
Haldia
Paradip
Bombay
Visakhapatnam
Mormugao
Mangalore
Madras
Cochin
Port Blair
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

## FOREIGN TRADE

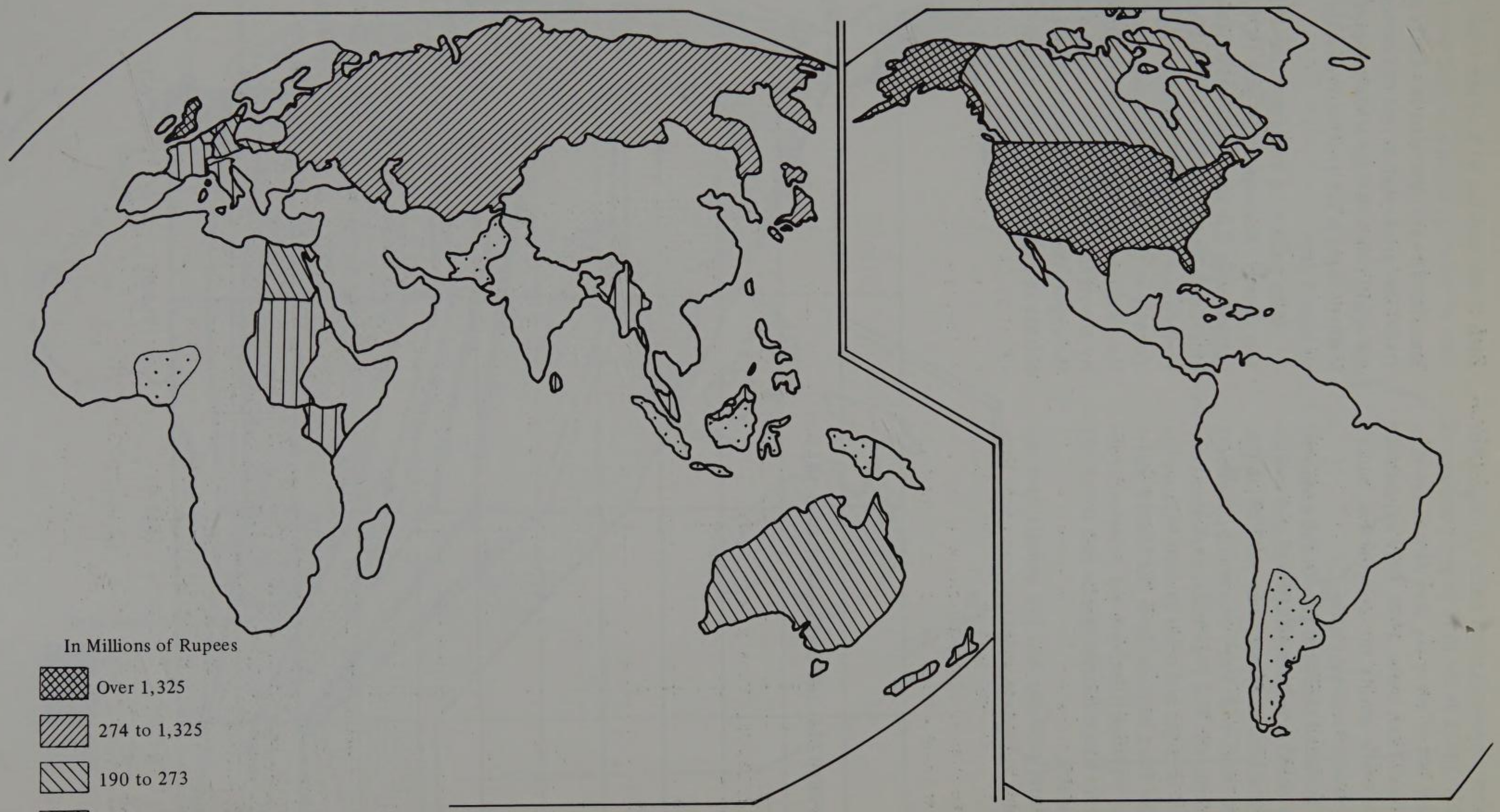
Prior to 1947 the foreign trade of India was largely restricted to the exchange of goods with Britain and other Commonwealth countries. Exports consisted mainly of agricultural products such as jute, tea, spices, and leather; minerals such as mica and manganese; and some agriculture-based industrial items as cotton textiles and jute goods. Imports were largely manufactured items including a great volume of consumer products. India had a favorable balance of payments because, as a little-industrialized colony, it did not need to import large quantities of industrial machinery, or raw materials which were available in the colony itself. This condition changed, however, in the 1970s as a result of the continued process of decolonization of the economy and the realignment of the country's international relationships.

Currently, in terms of exports and imports, the United States ranks first as a trading partner. Almost 25% of India's imports come from the United States while exports to that country constitute about 17% of India's total. In the early 1950s when India was in the process of altering the base of its former colonial economic structure, Britain was its principal supplier of imports. By the 1960s, however, American imports, compared to British, were so great that in 1969-70 they reached the ratio of 23 to 5. The new economic relationship with the United States is primarily the result of large-scale imports of food grains, machinery, and other aid goods. Meanwhile, Indian exports to the United States (jute, manganese, and handicraft items in particular) have increased considerably.

The Soviet Union and Communist East European nations have become new markets and sources of goods. Imports from these countries in 1950-51 constituted less than 1% of India's total trade. The Eastern Block nations now contribute almost 25% of India's total. Indian imports consist primarily of industrial support items, whereas exports are the traditional tea, jute, cotton textiles, leather, and leather goods.



**INDIA'S EXPORTS**
(Average of Annual Figures, 1965-70)

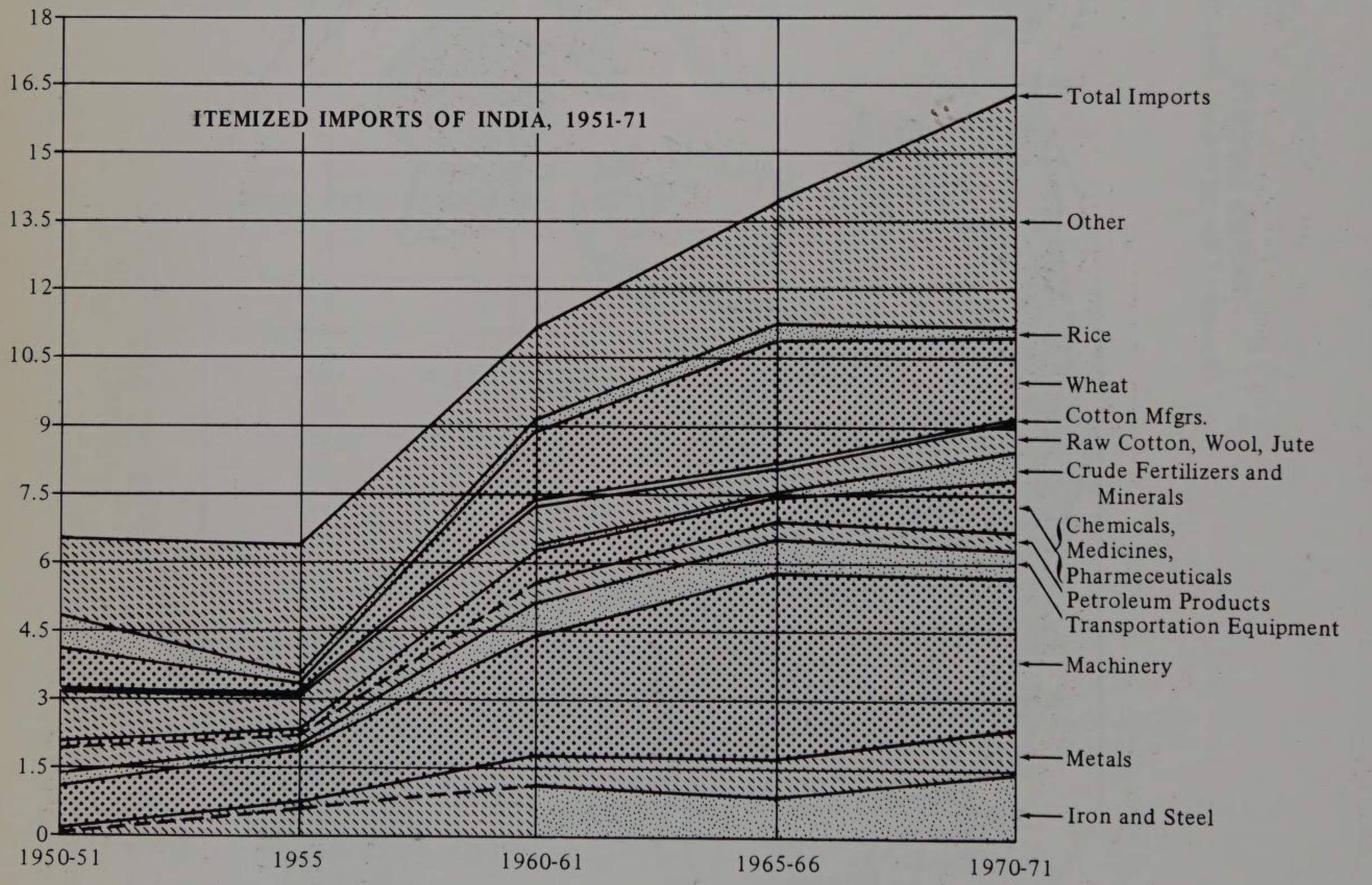


Japan is another new entrant on India's foreign trade roster. In 1971-72 it ranked as the third largest purchaser of Indian exports; one out of every six tons of iron ore consumed in Japan comes from India. Thus, from dependence on British Empire trade during the colonial era, India's trade now follows multidirectional routes.

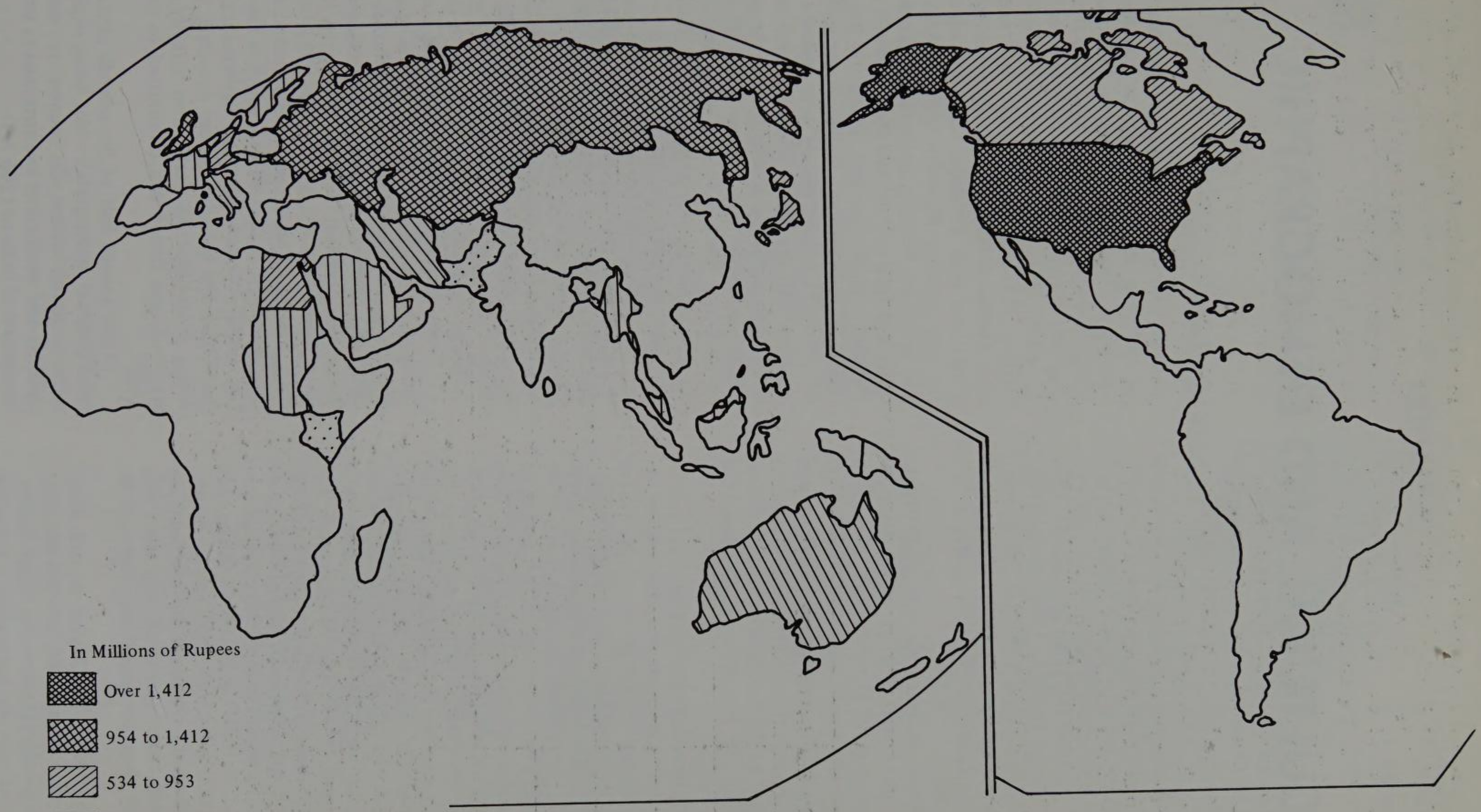
As a result of increased industrial growth and economic self-reliance, India requires more sophisticated and specialized types of manufactures. Thus, over 40% of Indian imports consist of iron and steel, machinery, transport equipment, and chemicals. The population explosion combined with frequent drought and other climatic vagaries has necessitated massive food imports from the United States and Canada. Other significant imports are petroleum (obtained primarily from Iran and other Middle East countries) and petroleum products.

While agricultural products and live animals have declined in significance as exports, manufactured goods have risen to account for 41% of the total. With the modernization of industry, exports of iron and steel and engineering manufactures are increasing at a faster rate than that for the traditional goods such as jute and cotton. In the area of raw materials, iron ore is the leading export earner, followed by leather. Sugar is yet another product increasing in value as an export item.

India's share of exports in the 1950s and 1960s grew very slowly. Between 1950 and 1970, India's exports increased only 2.5 times while the figure for the world was nine times. India's balance of trade, due to the country's need for specialized products and food stuffs, has been consistently in the red since independence: in the last years of the '60s food imports to India reached their highest level. By the middle of the 1980s, Indian planners estimate that the export-import imbalance will be corrected and that the balance of payments figures will be in India's favor.



**INDIA'S IMPORTS**
(Average of Annual Figures, 1965-70)



In Millions of Rupees

- Over 1,412
- 954 to 1,412
- 534 to 953
- 294 to 533
- 58 to 293
- Below 58
- Insignificant Import

# Chapter 7

# CULTURAL AND DEMOGRAPHIC

## HISTORICAL SETTING

The land of India is full of imprints cast by diverse racial, religious, and cultural groups who have either immigrated to the country or have come into contact with it. The history of India is generally divided into five periods: Dravidian (3000 B.C. to 1500 B.C.); Aryan or Hindu (1500 B.C. to 1206 A.D.); Moslem (1206 to 1757); British (1757 to 1947); and Independent India (1947 to the present). During these periods the traces left by the various groups have produced unique characteristics on the landscape and in the social life of India.

*The Dravidian Period.* Probably the first group of people to inhabit the country were a group of aborigines racially akin to the Negritos and Australoids. It is difficult to trace their origin. They now reside in the hills and plateaus where they were driven by the advancing Dravidians and Aryans. The Dravidians first occupied the fertile northwestern plains, followed by the Aryans. The aborigines have their primitive way of life and their religion based on animism.

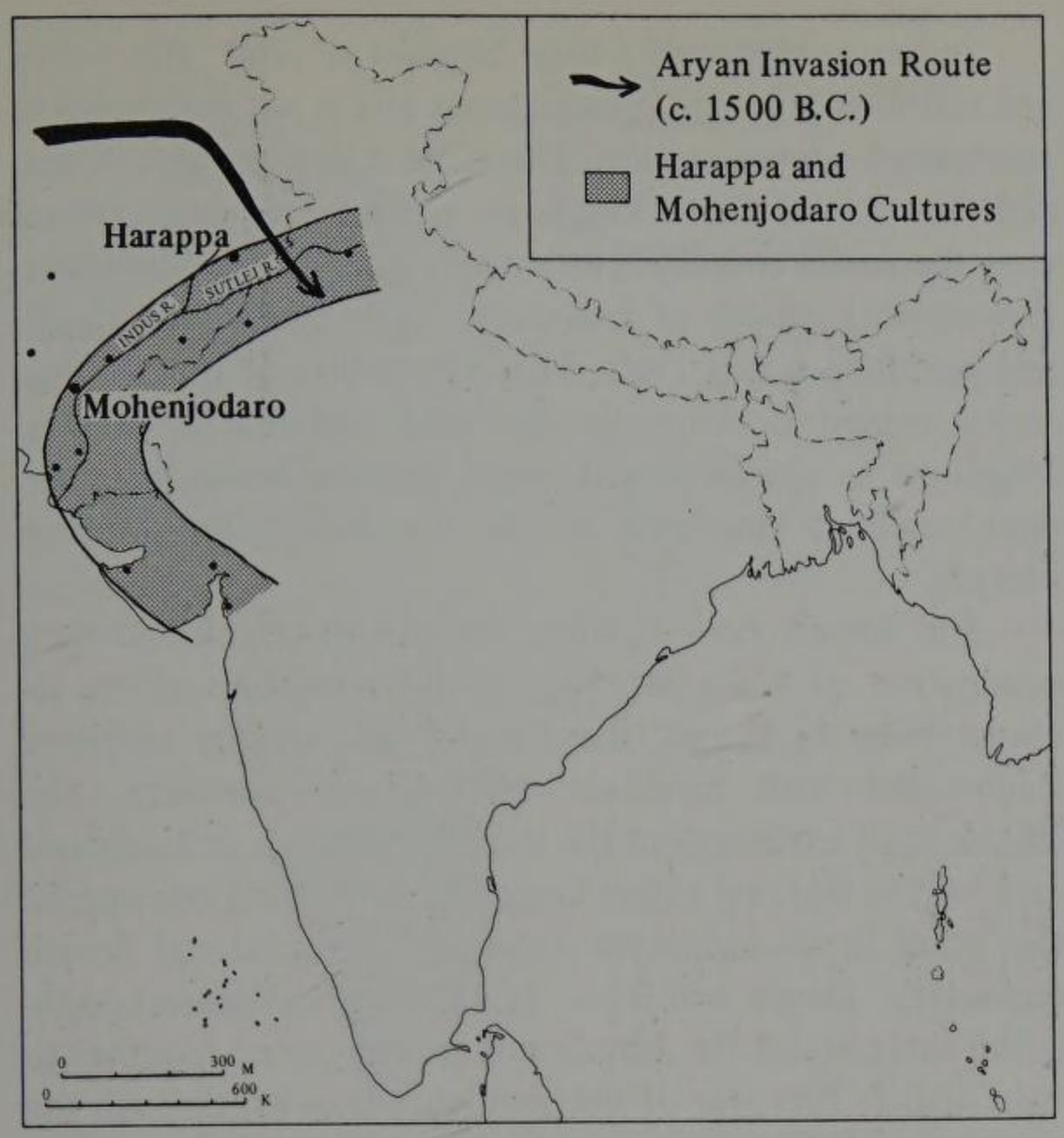
The origins of the Dravidians are as obscure as those of the aborigines. Numerous historians and archeologists regard them as being racially similar to the Mediterranean peoples. The Dravidians are basically of dark complexion and short stature. They developed an urban-based culture which flourished in the Indus Valley crescent between 2500 B.C. and 1500 B.C. The prime force behind the growth of their cities was a surplus of agricultural products. Their capital cities, Mohenjodaro and Harappa, the sites of which are situated in present day Pakistan, were also based on the prosperous agricultural economy in the Indus Valley. It has been determined that at that time the climate of the Indus Valley was more moist. In addition, the farmers utilized irrigation to increase production. Mohenjodaro and Harappa conducted trade by sea with Mesopotamia. The cities were well organized and carefully structured with the street layout based on the rectangular grid. Houses were two-storied, and some contained indoor baths. This plumbing feature was unique. No other ancient civilization, until the Romans almost 2,000 years later, enjoyed such luxury. The demise of the Dravidian civilization resulted from the Aryan incursions which began as gradual migrations into the Indus Valley and then developed into full-scale invasions.

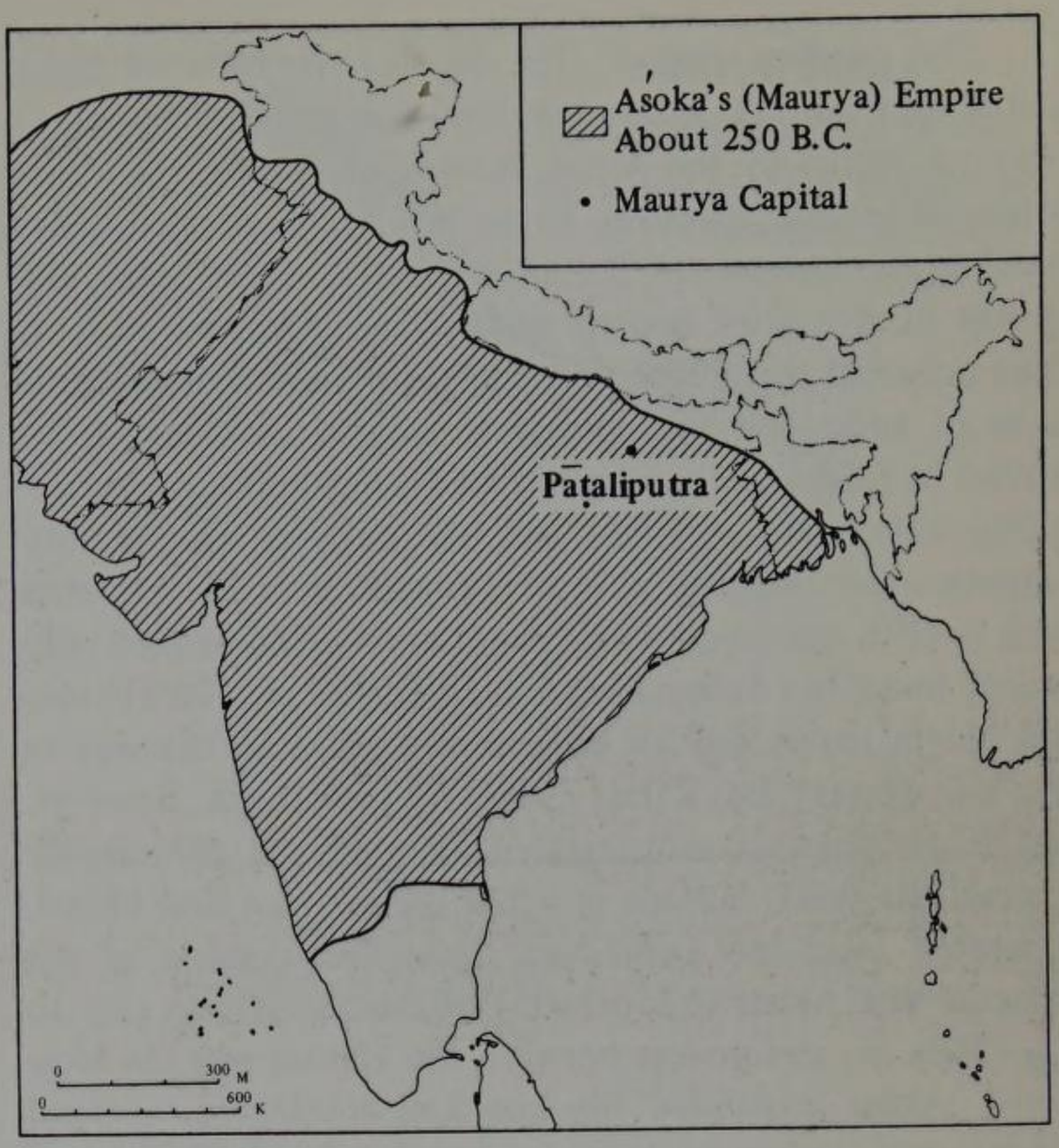
*The Hindu Aryan Period.* The Aryans of Indo-European Caucasoid stock were fair-skinned, tall, and had sharp facial features. They originally inhabited the steppe lands of central Asia and practiced nomadic pastoralism. Formidable warriors who utilized horses and chariots, the Aryans had no difficulty in driving out the comparatively peaceful Dravidians. The Aryan conquerers felt no affinity for urban living. The Dravidian cities, abandoned after 1500 B.C. and gradually buried under the sediments from the Indus and its tributaries, were not excavated from the debris until this century. The Aryans had brought with them their religion, later known as Hinduism, which was based on the sacred *Vedas,* and their particular social life which was based on the caste system: Brahmins (priests), Kshatriyas (nobility and warriors), Vaishyas (traders and farmers), and Sudras (serfs and hard manual laborers). While a segment of the Dravidian population was driven by the Aryans to the regions of the south and farther to the east, a sizable number of the conquered people were enslaved and eventually absorbed into the Hindu society as serfs and slaves. They were relegated to the lowest rank of the social castes, the Sudras. In south India, where Brahmins from the north intruded into the society at a much later stage of history, the Dravidians in general maintained much better social status than that of the north.

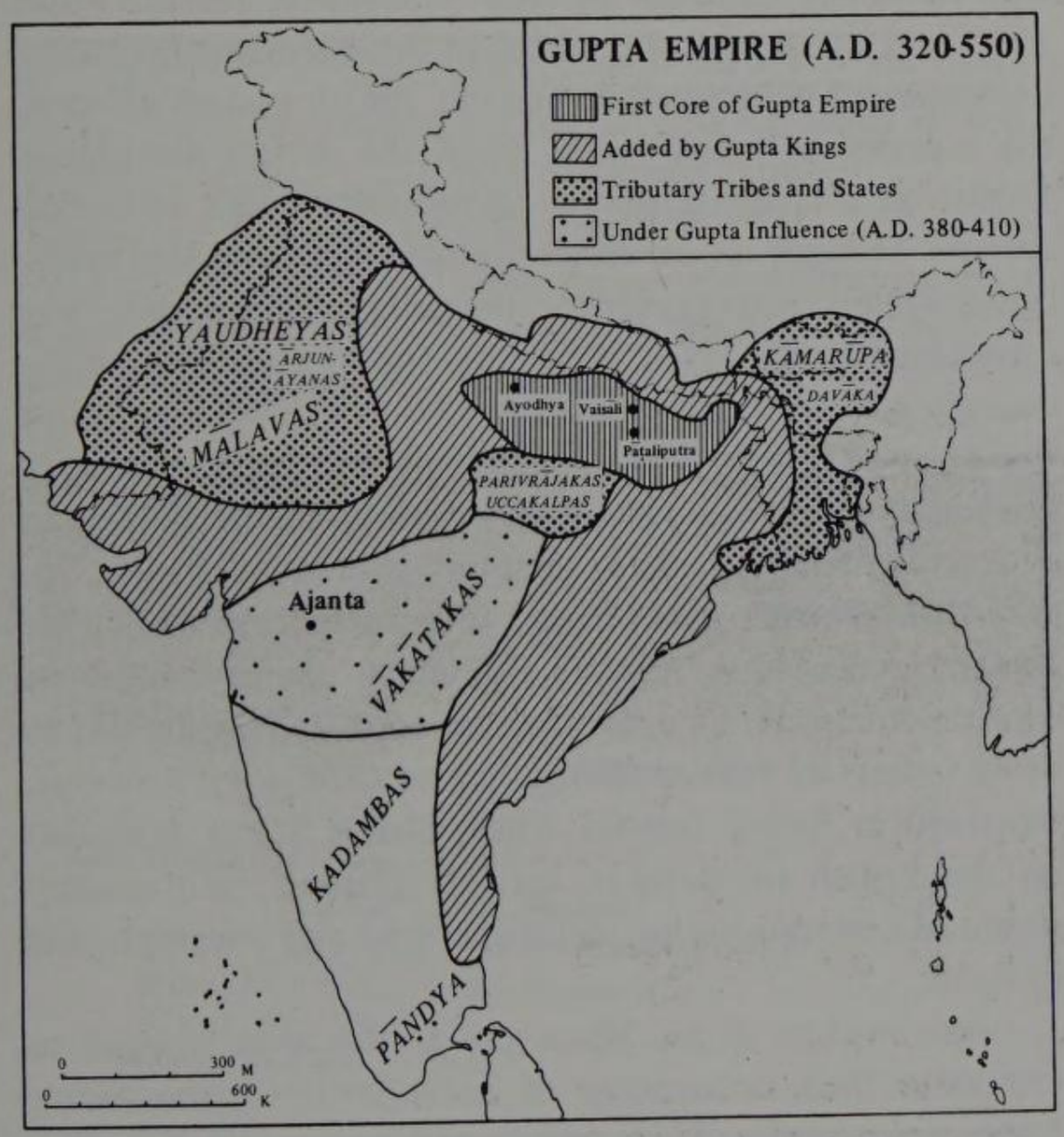
The Aryans organized into a national state in 324 B.C., two years after the invasion of Alexander the Great, and founded the historical Maurya Dynasty. The greatest of the Maurya kings, Asoka (269-232 B.C.), who eventually adopted Buddhism as the state religion, succeeded in unifying almost all of India under his leadership. Asoka's kingship was also significant for the fact that it was the first rule to bridge the political gap between north and south India.

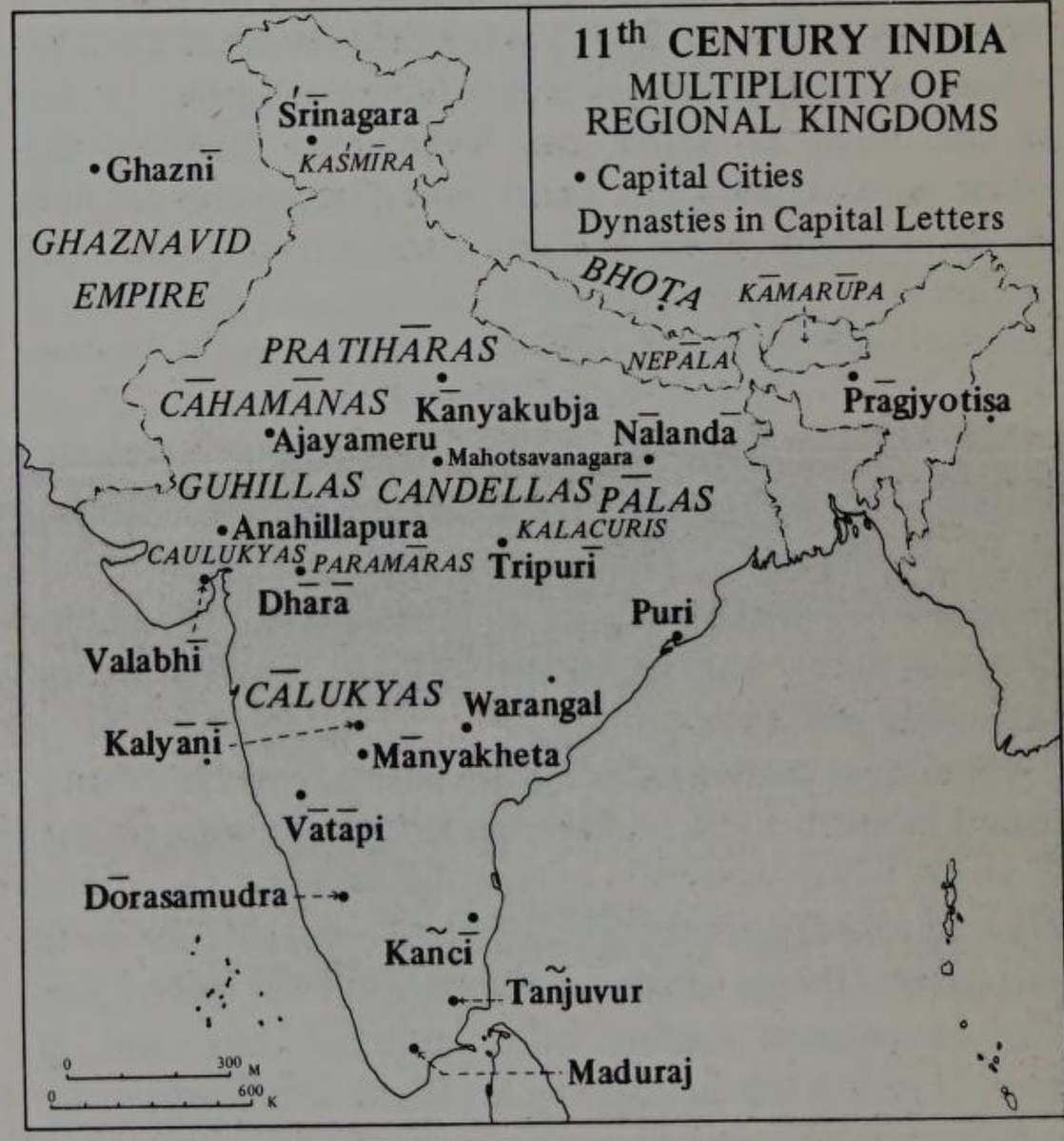
Soon after Asoka's death, political conditions in the country became chaotic and the central administration disintegrated. The disorganization was further aggravated by additional invasions by new Aryan migrants (Sakas, Parthians, and Kushans) from the Northwest. It was not until the Imperial Gupta Age (320-550 A.D.) that all of north India was again united under one centralized administration. During the Gupta Period, which is also known as the Golden Age, the arts, sciences, mathematics, and literature flourished. The so-called Arabic numerals, which are used widely throughout the world, were actually developed during the Gupta Period and transmitted to the West by the Arabs.

In the second half of the seventh century India again faced political disintegration. Not being organized into one cohesive central system, the country was divided into principalities and small states and remained so until the Moslem occupation of India in 1206 A.D.


Aryan Invasion Route
(c. 1500 B.C.)
Harappa and
Mohenjodaro Cultures
Harappa
SUTLEJ R.
INDUS R.
Mohenjodaro
0 300 M
0 600 K


Aśoka's (Maurya) Empire
About 250 B.C.
• Maurya Capital
Pāṭaliputra
0 300 M
0 600 K


GUPTA EMPIRE (A.D. 320-550)
First Core of Gupta Empire
Added by Gupta Kings
Tributary Tribes and States
Under Gupta Influence (A.D. 380-410)
YAUDHEYAS
ĀRJUN-
ĀYANAS
MĀLAVAS
KĀMARŪPA
DAVAKA
Ayodhya
Vaisali
Pataliputra
PARIVRĀJAKAS
UCCAKALPAS
Ajanta
VĀKĀṬAKAS
KADAMBAS
PĀṆḌYA
0 300 M
0 600 K


11th CENTURY INDIA
MULTIPLICITY OF
REGIONAL KINGDOMS
• Capital Cities
Dynasties in Capital Letters
Srīnagara
KAŚMĪRA
• Ghazni
GHAZNAVID
EMPIRE
BHOṬA
KĀMARŪPA
NEPĀLA
PRATIHĀRAS
CĀHAMĀNAS
Kanyakubja
Ajayameru
Mahotsavanagara
Nālanda
Pragjyotiṣa
GUHILLAS
CANDELLAS
PĀLAS
Anahillapura
KALACURIS
CAULUKYAS
PARAMĀRAS
Tripurī
Dhara
Puri
Valabhī
CĀLUKYAS
Warangal
Kalyaṇi
Mānyakheta
Vatapi
Dorasamudra
Kañcī
Tañjuvur
Maduraj
0 300 M
0 600 K

*The Moslem Period.* The Moslem invasion of India dates back to 711 A.D. when Sind (presently in Pakistan) was conquered by the Arabs. Actual occupation of the territory in general, however, began in 1206 when Kutbuddin established himself as Sultan of Delhi. Thus began the group of dynasties known as the Turko-Afghan Sultans. The principal reason for the success of the Moslem occupation of India was the religious fervor of Islam which inspired its followers to conquer non-Islamic lands. A contributing cause, in addition, was the division and enmity amongst the indigenous Indian kingdoms in the eleventh and twelfth centuries. The Sultans as a rule controlled only north India, but Sultan Mohammad Tughluq (1325-51) succeeded in expanding his empire southward all the way to include present-day Kerala. Soon after his death, however, his huge kingdom disintegrated. The Islamic Moguls displaced the weak Sultans in 1526. Babur, the first Mogul, operated from the Delhi-Agra Core. The greatest of the Moguls was Akbar (1556-1605) who attempted in vain to reconcile the differences between the Hindus and the Moslems. Akbar expanded his kingdom southward, a trend which was continued both by his grandson, Shah Jahan (who had the Taj Mahal built), and his great-grandson, Aurangzeb (1659-1707), who was a religious fanatic and an arch enemy of all followers of non-Islamic religions. As during the times of Asoka and Mohammad Tughluq, the greater part of India was again united under one political rule. Overexpansion, high taxation imposed on Hindus, and the parochial policies pursued by Shah Jahan and Aurangzeb eventually resulted in the demise of the Mogul Empire.

*The South Indian Scene.* While empire building and dynastic changes were occurring in north India during the Aryan and Moslem periods, the south was also experiencing similar developments. Of its many regional kingdoms; Pallavas (30-897 A.D.), Pandyas (590-920 A.D.), Cholas (590-920 A.D.), and Vijaynagar (1398-1525 A.D.) were particularly eminent.

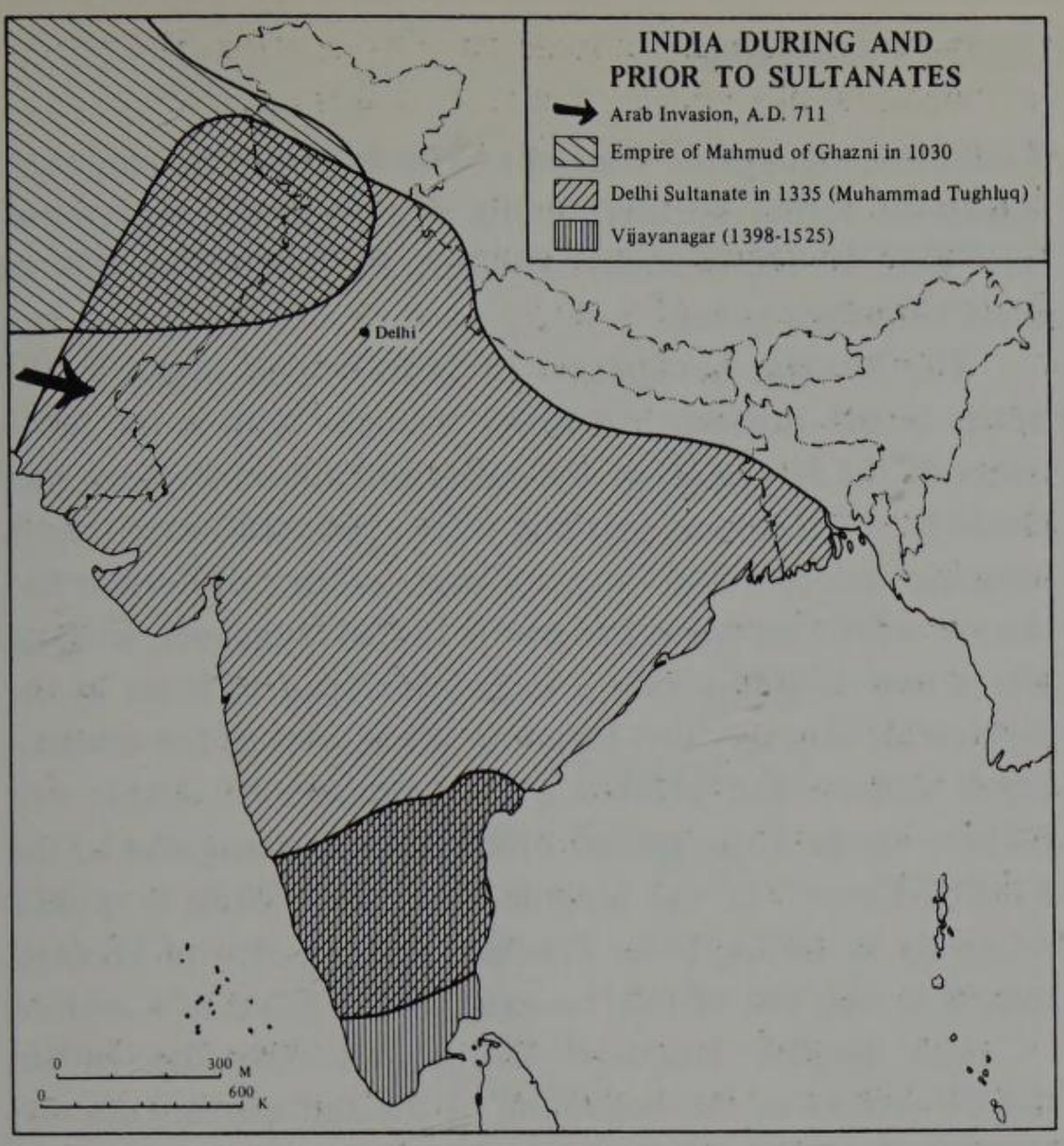
The main centers of political control were historically located in north India (mainly the Ganges-Yamuna plains). No south Indian kingdom, except the Marathas for a brief period in the eighteenth century, ever reigned over north India. South Indian kingdoms compensated for this by pursuing ocean-based trading with Southeast Asia, and, at times, by politically subjugating Sri Lanka and Burma.

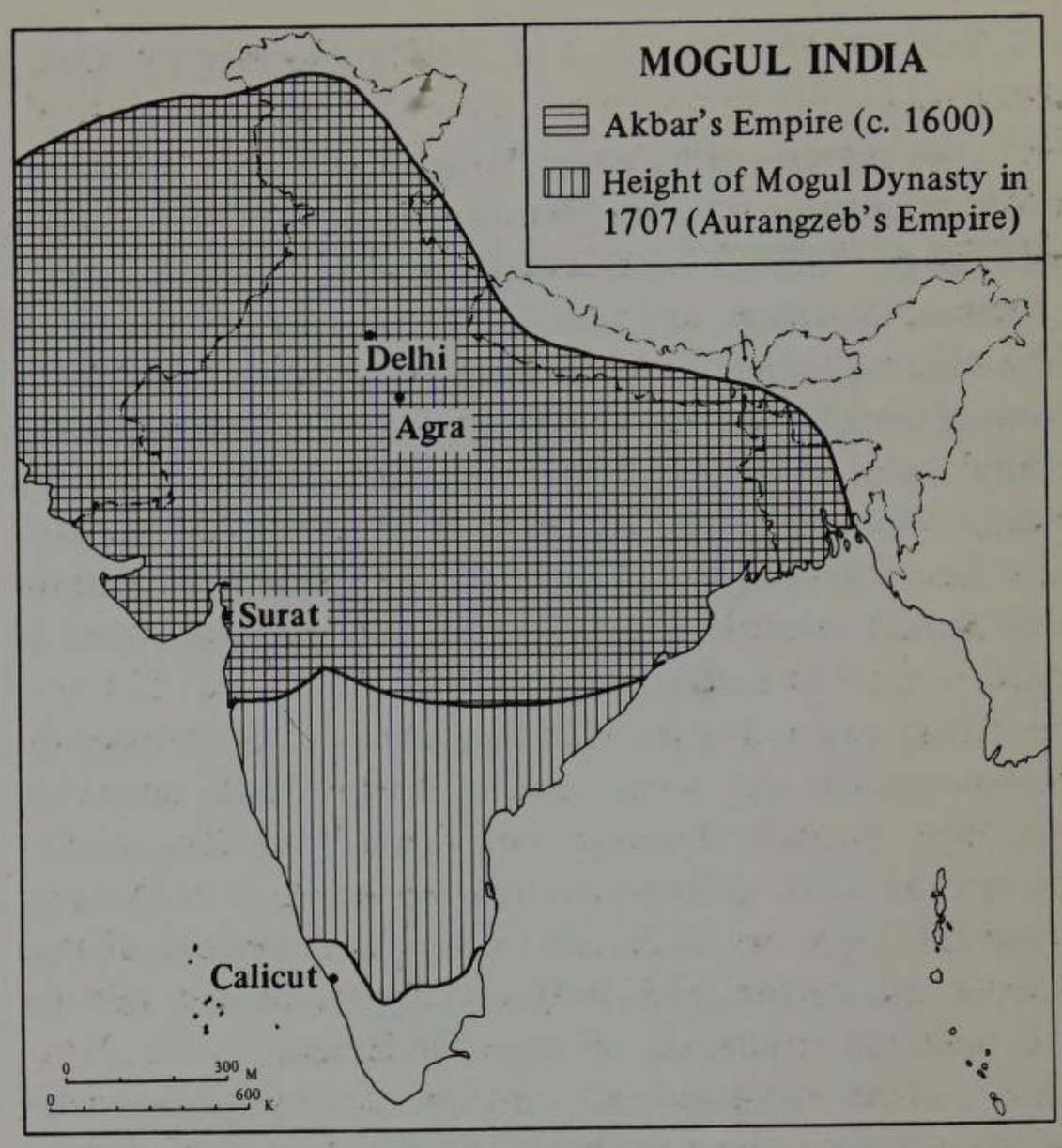
The Indus-Ganges Plain always had superior resources (both human and agricultural) to those of south India and thus was able to maintain powerful core areas which succeeded in effectively controlling parts or all of the southern region. Nevertheless, at times when those northern core areas became weak through mismanagement, disorganization, and lack of vision on the part of the kings and their counselors, the peripheral regions (south India was always in the periphery in relation to the north Indian core) declared their independence or strengthened their independent status.

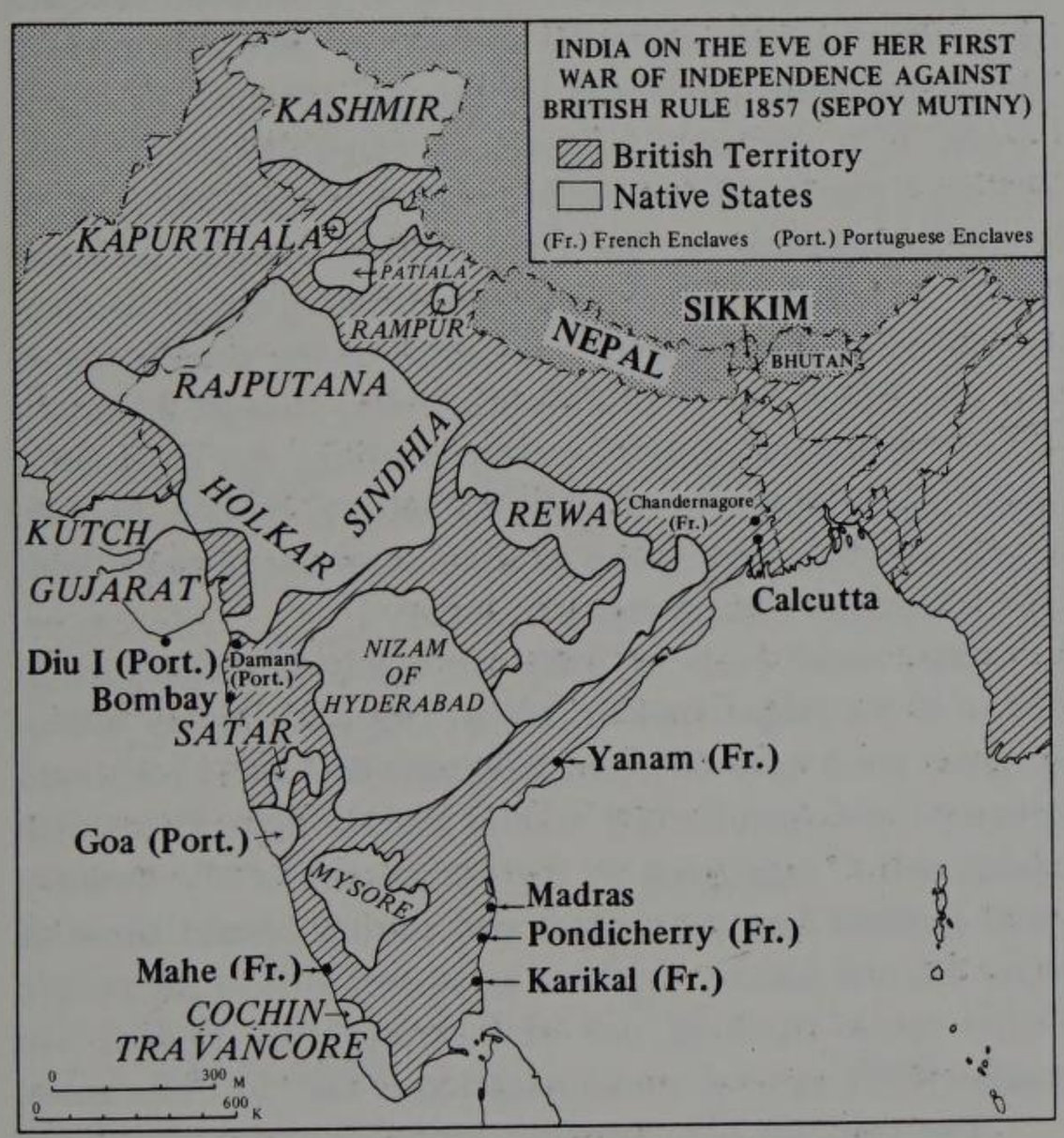
India encompasses a huge amount of land. The southern region is hilly and mountainous and is not conducive to centralized administration. Therefore it was not always possible for the northern kingdoms to maintain easy control over the entire country, particularly given the cumbersome, slow-moving modes of transport: horse carts, foot travel, and primitive sailing craft. The very nature of Indian geography caused occasionally powerful and united national kingdoms to alternate with small, but numerous, independent regional kingdoms during the Aryan and Moslem periods.

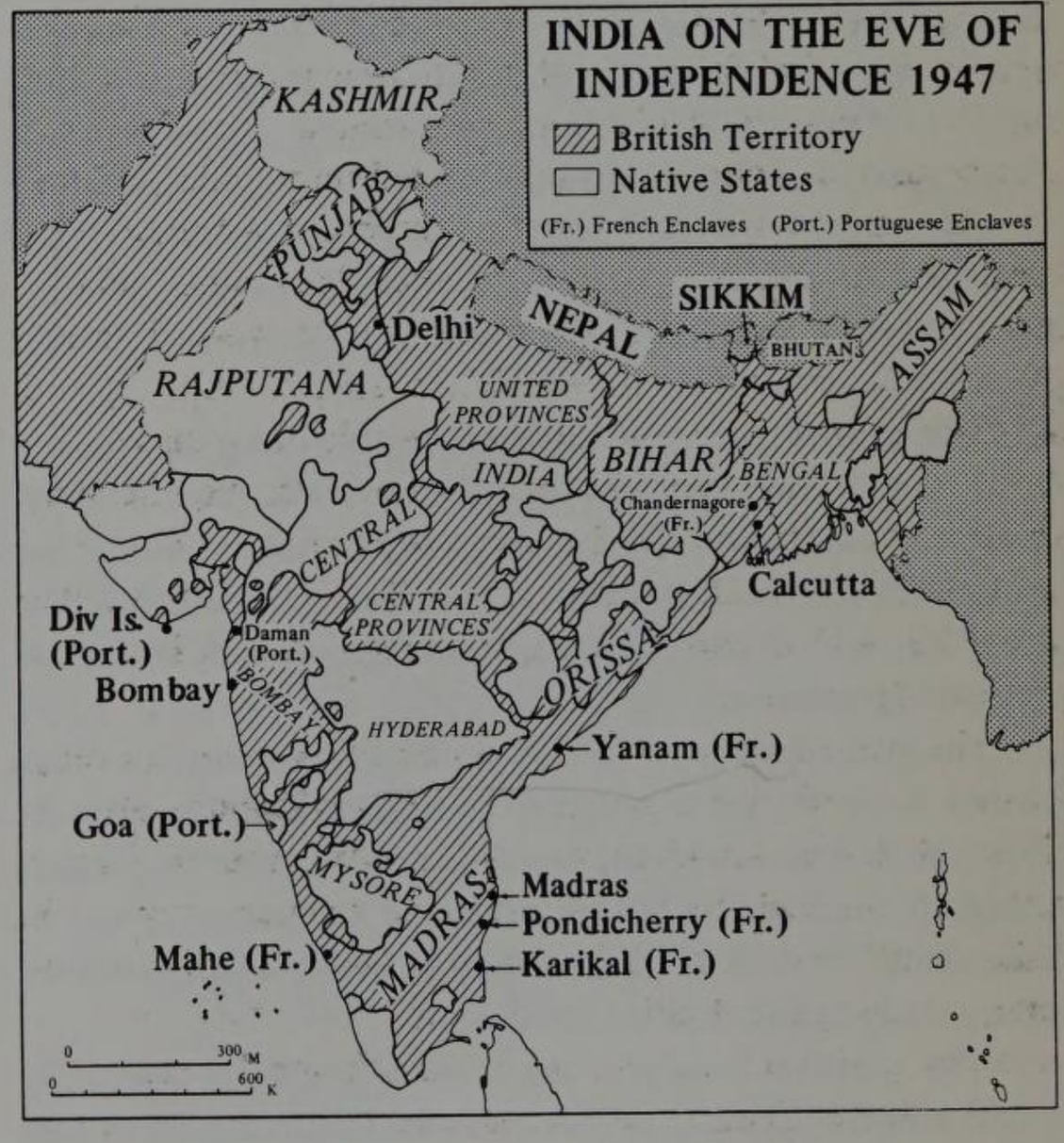
*The British Period.* When the British established their occupation of India in 1757 by defeating one of the regional kings in Bengal, the country was already seriously fragmented with incessant interregional conflicts. The British took advantage of the internal divisions and subdued each of the regional native kingdoms by playing one against the other in an admirable display of a traditional British diplomacy: *Divide and Rule.* By 1857 the indigenous population understood the British policy and joined together to fight India's first war of independence (known through the writings of British historians as the Sepoy Mutiny) which was ruthlessly crushed by the occupation forces. From 1857 to 1947 British supremacy in India remained virtually unchallenged. The two-century old British system affected the country in many ways. First, the British introduced English as a language in the administration and education system. Second, an extensive railroad network was established. Third, a westernized bureaucratic civil service was introduced, which even now perpetuates a self-generating, corrupt administrative apparatus. Fourth, a new group of Indian elites was created, trained in the westernized colonial system of education. They were unable to adapt to a developmental directed economy and nationalistic oriented social needs after India's independence. Finally, the British succeeded in uniting the entire country under its own colonial rule. One-third of the country was allowed to be governed by *Native States,* whose suzerainty, however, remained in British control. These Native States depended on the British for defense, foreign relations, and modern means of communication: railroads, post and telegraph, and so forth.

*Independent India.* When the British were obliged to terminate their occupation of India in 1947, the Native States (numbering 562) which had never joined India's struggles for independence in the twentieth century, were reluctant to join the Indian Union. Eventually those states were incorporated into the Indian Union either voluntarily or, in some instances, by force. The entire country was then reorganized into states, the basis of which was primarily linguistic. The boundaries of the older Native States, in most cases, were obliterated to facilitate the formation of new administrative boundaries.


INDIA DURING AND PRIOR TO SULTANATES
Arab Invasion, A.D. 711
Empire of Mahmud of Ghazni in 1030
Delhi Sultanate in 1335 (Muhammad Tughluq)
Vijayanagar (1398-1525)
Delhi
0 300 M
0 600 K


MOGUL INDIA
Akbar's Empire (c. 1600)
Height of Mogul Dynasty in 1707 (Aurangzeb's Empire)
Delhi
Agra
Surat
Calicut
0 300 M
0 600 K


INDIA ON THE EVE OF HER FIRST WAR OF INDEPENDENCE AGAINST BRITISH RULE 1857 (SEPOY MUTINY)
British Territory
Native States
(Fr.) French Enclaves (Port.) Portuguese Enclaves
KASHMIR
KAPURTHALA
PATIALA
RAMPUR
NEPAL
SIKKIM
BHUTAN
RAJPUTANA
SINDHIA
HOLKAR
KUTCH
GUJARAT
REWA
Chandernagore (Fr.)
Calcutta
Diu I (Port.)
Daman (Port.)
Bombay
SATAR
NIZAM OF HYDERABAD
Yanam (Fr.)
Goa (Port.)
MYSORE
Madras
Pondicherry (Fr.)
Karikal (Fr.)
Mahe (Fr.)
COCHIN
TRAVANCORE
0 300 M
0 600 K


INDIA ON THE EVE OF INDEPENDENCE 1947
British Territory
Native States
(Fr.) French Enclaves (Port.) Portuguese Enclaves
KASHMIR
PUNJAB
Delhi
NEPAL
SIKKIM
BHUTAN
ASSAM
RAJPUTANA
UNITED PROVINCES
BIHAR
BENGAL
INDIA
CENTRAL
Chandernagore (Fr.)
Calcutta
CENTRAL PROVINCES
ORISSA
Div Is. (Port.)
Daman (Port.)
Bombay
BOMBAY
HYDERABAD
Yanam (Fr.)
Goa (Port.)
MYSORE
MADRAS
Madras
Pondicherry (Fr.)
Karikal (Fr.)
Mahe (Fr.)
0 300 M
0 600 K

## LANGUAGES AND LINGUISTIC PROBLEMS

The pattern of languages in India is closely associated with the history of migration in the country. Five major language families–unspecified African, Austric, Sino-Tibetan, Dravidian, and Indo-European–have influenced all the existing Indian languages. Negroid migrants from Africa were probably the first group of people to inhabit India. Only traces of their language are to be found in languages which survived to later times. In India today, no true African language exists either in written or spoken form despite the existence of Negroid races in the Andamans and in remote parts of Tamilnadu.

The Austric family of languages, brought to India by early migrants whose origins were possibly Indochinese, at one time prevailed throughout the country. These languages were eventually absorbed by the Dravidian or Indo-European languages, or were confined to hilly and secluded areas such as the Chotanagpur Plateau (Santali, Mundari, and the Ho language groups), or the Assam Hills (Khasi).

The Sino-Tibetan family of languages, which originated in the Chinese plains, was brought to India by Mongoloid racial groups. In the Sanskrit literature of ancient times these groups were referred to as *Kiratas.* Prior to the influx of the Aryans into India, the Sino-Tibetan languages prevailed over large sections of northern India. Later, this language group, as had happened with the Austric, was absorbed into the expanding Indo-European languages. Sino-Tibetan languages are still found in the relatively inaccessible mountainous regions of the Himalayas and in the eastern hills.

The Dravidians, who inhabited India during the time of the Indus Valley civilization prior to 1500 B.C., evolved their own language. Although ancient tablets and coins bearing Dravidian inscriptions have been found, the language has not yet been satisfactorily deciphered. When the Aryans overpowered the Indus Valley civilization in 1500 B.C., a great number of Dravidian-language family speaking people were forced to migrate southwards. Four states in south India have preserved the Dravidian family languages; Telugu in Andhra Pradesh, Kannada in Karnataka, Tamil in Tamilnadu, and Malayalam in Kerala. These languages were later greatly influenced by Sanskrit.

The Aryans brought their own language, Sanskrit, which had branched from the Indo-European family; it was widespread in north India beginning in 1500 B.C. While this language also absorbed a great number of Dravidian words, the foundations of the North Indian languages, nevertheless, remained separate from the Dravidian. Like Latin, Sanskrit is no longer a spoken language. Linguists commonly divide the Indo-European languages in India in two groups, Indo-Aryan and Dordic. The latter, greatly influenced by Sanskrit, has been preserved in the form of the Kashmiri language of Kashmir. The Indo-Aryan languages spread all across northern India where various representatives may be found today. Hindi is the most important of these languages today.

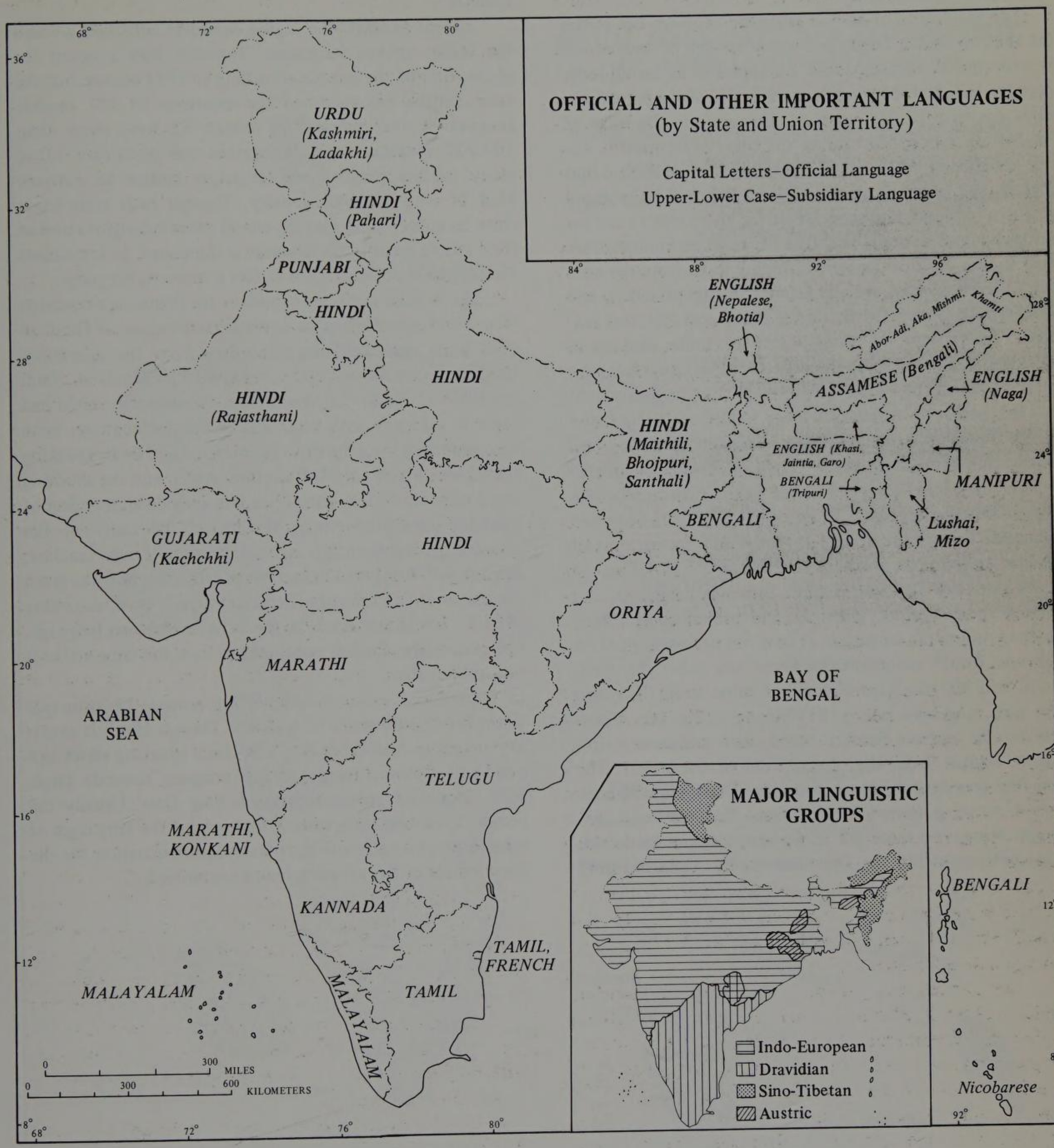
The Moslem occupation of India which began in the north in the thirteenth century brought with it the influences of the languages of the rulers and administrators, particularly Persian and Arabic. The Sanskrit-based Hindi language incorporated into it a large number of Persian and Arabic words, as did other north Indian languages. Eventually a new language called Urdu developed in India in the eighteenth century. It is based on the idioms of the Western Hindi dialect, but utilizes a great number of Arabic and Persian words. Urdu gained prestige as "the language of the Exalted Court" of the Moguls. Currently, Urdu is spoken primarily in Delhi, Uttar Pradesh, and the city of Hyderabad. It is also the official language of the State of Kashmir.

The English language, introduced into the Indian school system at the beginning of the last century for the convenience of the British administrators, brought with it influences from the Western World. It is through this language that modern scientific ideas have been conveyed to the Indian elite, for whom English still remains the *lingua franca.* It is the only language spoken throughout India, although the actual number of speakers is small. As a result, mass communication on a nationwide scale is difficult. Hindi, the single most widely understood of the Indian languages, is spoken by over one-fourth of the people, but is not comprehended at all in south India. Though the multilingual character of the country provides the basis for a regionally differentiated cultural setting, a man to man intercommunication at the national level becomes difficult and sometimes creates regional rivalry.

Only small parts of India are highly homogeneous in terms of languages spoken (see p. 79). Such highly homogeneous areas have different languages and are (1) centered around Delhi-Agra-Kanauj core in the Northern Plains with Hindi and (2) scattered in the peripheries of the country with regional languages developed during certain times of their cultural history. In those areas over 90% of the people either speak Hindi or one of the respective regional languages. Intraregional communication is easy in those areas.

The medium homogeneous group occupies large parts of the country. Within this group 60% to 90% of the people generally speak the same language spoken by the bordering highly homogeneous areas.

The heterogeneous and highly heterogeneous areas, where less than 60% of the people speak one of the many languages, are scattered all over the country in the remote and generally hilly regions with a few exceptions, such as in the eastern part of the Eastern Plains and in Punjab. Hindi


OFFICIAL AND OTHER IMPORTANT LANGUAGES
(by State and Union Territory)
Capital Letters–Official Language
Upper-Lower Case–Subsidiary Language
URDU (Kashmiri, Ladakhi)
HINDI (Pahari)
PUNJABI
HINDI
HINDI (Rajasthani)
HINDI
HINDI (Maithili, Bhojpuri, Santhali)
GUJARATI (Kachchhi)
HINDI
MARATHI
TELUGU
MARATHI, KONKANI
KANNADA
TAMIL, FRENCH
MALAYALAM
TAMIL
ENGLISH (Nepalese, Bhotia)
Abor-Adi, Aka, Mishmi, Khamti
ASSAMESE (Bengali)
ENGLISH (Naga)
ENGLISH (Khasi, Jaintia, Garo)
BENGALI (Tripuri)
MANIPURI
BENGALI
Lushai, Mizo
ORIYA
BAY OF BENGAL
ARABIAN SEA
BENGALI
Nicobarese
MILES
KILOMETERS
MAJOR LINGUISTIC GROUPS
Indo-European
Dravidian
Sino-Tibetan
Austric

and the principal regional languages have not been able to penetrate these areas because of their relative cultural isolation. These areas present the greatest problems in intra-regional communication.

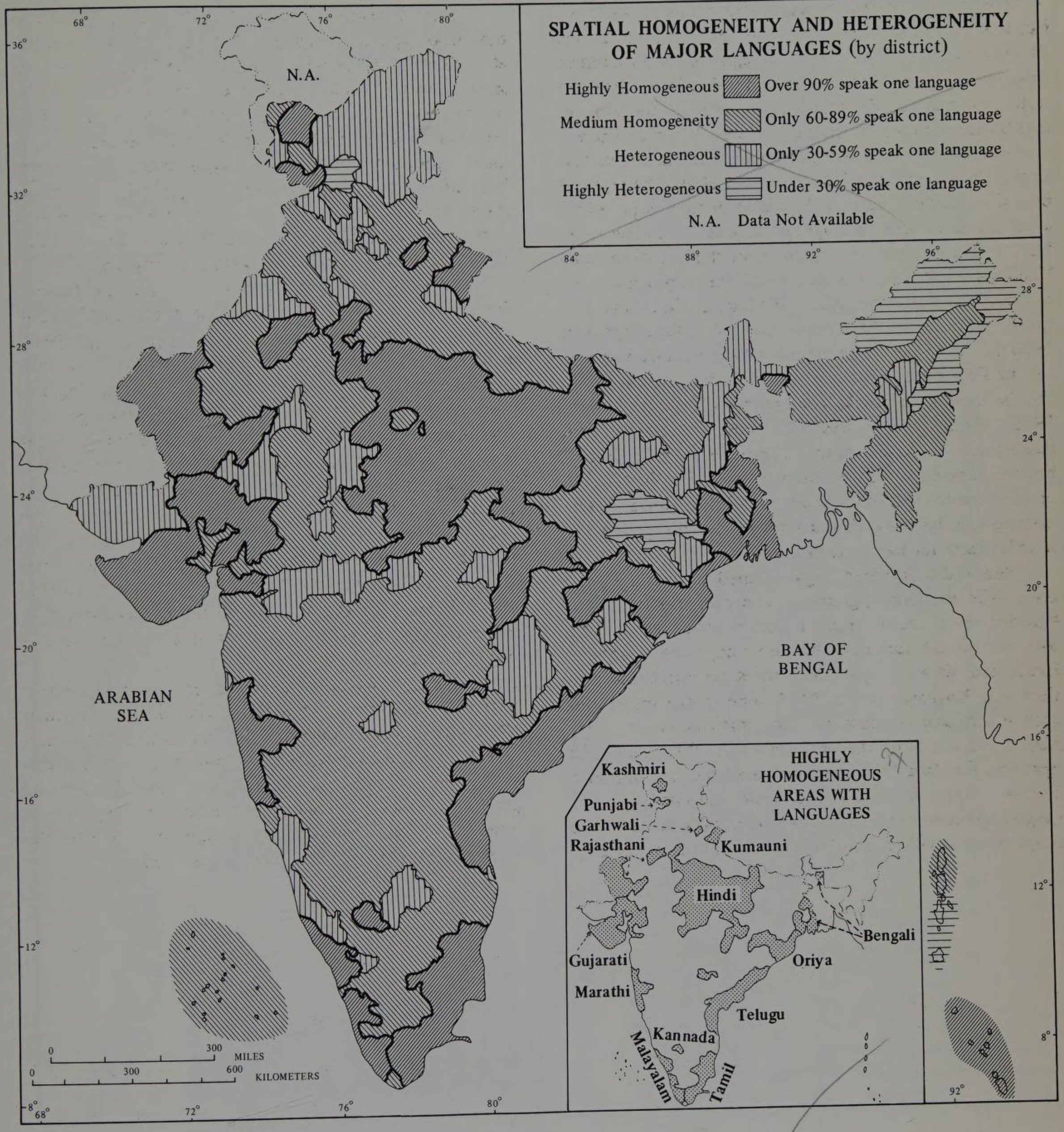
The main crux of India's linguistic problem lies in the fact that no Indian language is either spoken or understood all over India. English could be regarded as an all-India language but probably less than 2% to 3% of the people can really converse in this language. However, in the wake of anti-British nationalism during the pre-1947 period it was well established in the minds of Indian national leaders that English, the language of the enslavers, should be replaced by a new national language. Moreover, there was a need for a popular-level national language for mass communication. Most Indian political leaders, including those from the non-Hindi speaking areas such as Gandhi, Rajagopalachari, and Subhas Bose, advocated that only Hindi could be that language. As a result the Constitution of India adopted in 1950 declared Hindi to be the official and national language for the Federal (or Union) government, but English would also be used as an official language for fifteen years (until 1965). Fourteen languages were included as major languages; they are known as the "Eighth Schedule languages" because they have been mentioned in the Eighth Schedule of the Constitution. Hindi, being one of the Eighth Schedule languages, is both an official language for the nation and state language for six northern states.

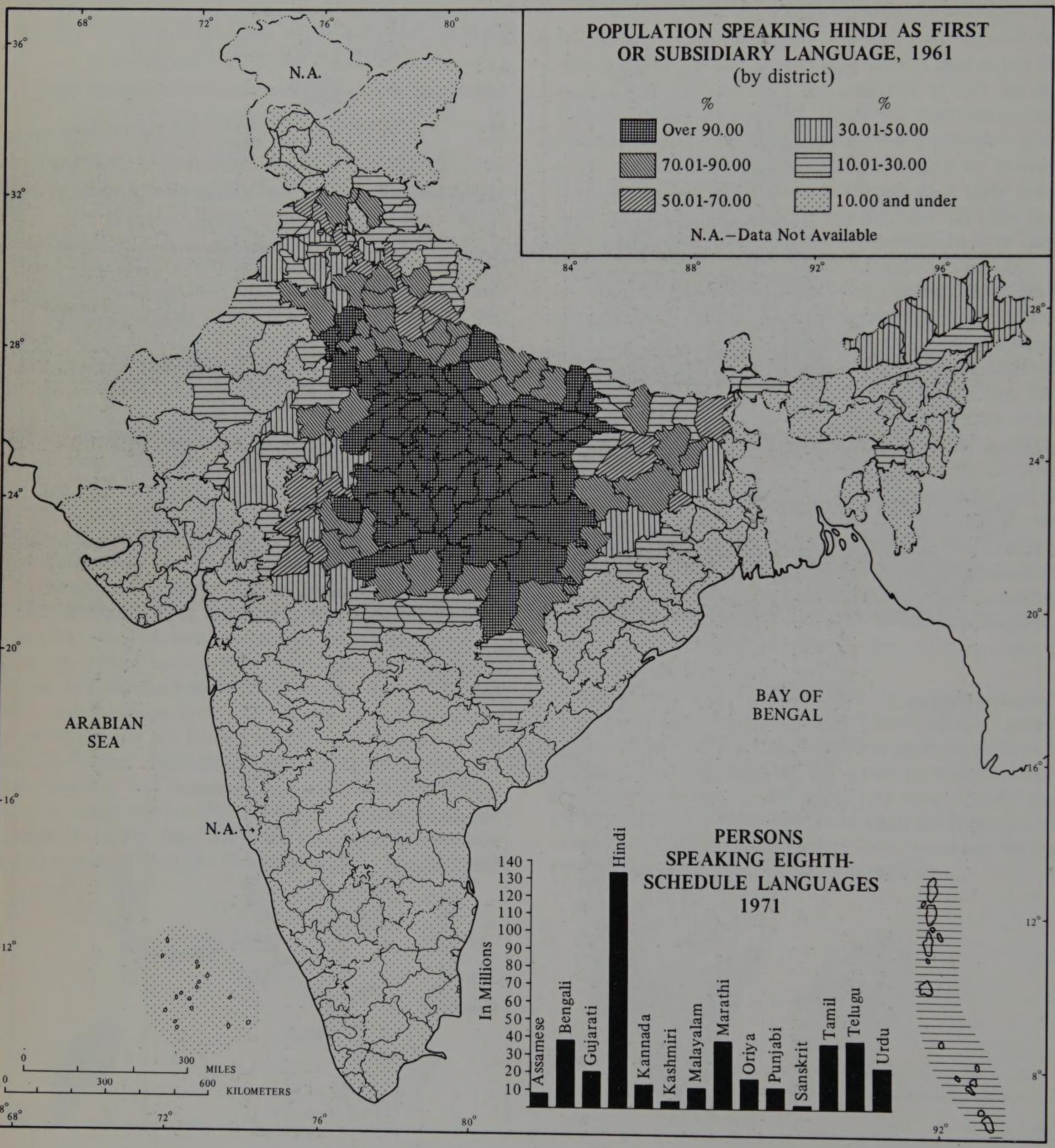
Within the fourteen Eighth Schedule languages one finds different scripts, grammar, and pronunciation; even knowing one of the languages, it does not necessarily follow that one would automatically know any other. Sanskrit, Hindi, and Marathi have almost the same script. The two thru nine languages (see p. 81) belong to the Indo-European family and are Sanskrit-based; their common script-base is evident from the organization of the letters. The next four (ten thru thirteen), which are Dravidian languages have a script pattern different from Sanskrit-based languages. Moreover, there are some basic differences in the script pattern within the Dravidian family. Urdu not only has a completely different script (Arabic base) but it is read from the right to the left, whereas the Sanskritized and Dravidian languages are read from the left to the right like English.

Except Sanskrit the Eighth Schedule languages are also the major spoken languages. Together they account for about 70% of the people according to 1971 census, but the same census has recorded the existence of 281 mother tongues in the country, of which 82 have more than 100,000 speakers each. Altogether the prevalence of so many mother tongues and languages creates an extreme kind of regional heterogeneity. Though each state has a state language, there may be one or more subregions in that state where some other language is dominant. In some cases the official state language is in fact a minority language.

Under such a diverse situation the linguistic extremists from Hindi speaking areas advocate imposition of Hindi all over India, whereas the extremists from the non-Hindi speaking areas frown upon the spread of Hindi as Hindi imperialism. By the middle of the '60s when the time had come to do away with English as an official language, there was extensive resentment in many non-Hindi speaking states, which not only led to riots, arson, and the shooting down of protesters by the police, but created a great deal of political instability which threatened the unity of the country. Consequently, a "compromise" was reached; English was continued as an official language, but was given the status of "additional official language." Thus, according to strict semantics Hindi is the official national language, but practically, English continues to have the same status it had in the fifties.

In the end, mass communication remains the principal victim of this diversity of tongues. Though Hindi is generally taught in high schools of non-Hindi speaking states as a noncredit optional language, its progress towards large-scale, interstate communication is very slow. Usually the people from one state cannot understand the languages of other states. As a result, interstate communication for the great masses of the people remains unresolved.


SPATIAL HOMOGENEITY AND HETEROGENEITY OF MAJOR LANGUAGES (by district)
Highly Homogeneous — Over 90% speak one language
Medium Homogeneity — Only 60-89% speak one language
Heterogeneous — Only 30-59% speak one language
Highly Heterogeneous — Under 30% speak one language
N.A. Data Not Available
N.A.
ARABIAN SEA
BAY OF BENGAL
HIGHLY HOMOGENEOUS AREAS WITH LANGUAGES
Kashmiri
Punjabi
Garhwali
Rajasthani
Kumauni
Hindi
Bengali
Oriya
Gujarati
Marathi
Telugu
Kannada
Malayalam
Tamil
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°


POPULATION SPEAKING HINDI AS FIRST OR SUBSIDIARY LANGUAGE, 1961
(by district)
%
Over 90.00
70.01-90.00
50.01-70.00
%
30.01-50.00
10.01-30.00
10.00 and under
N.A.–Data Not Available
N.A.
ARABIAN SEA
BAY OF BENGAL
PERSONS SPEAKING EIGHTH-SCHEDULE LANGUAGES 1971
In Millions
Hindi
Assamese
Bengali
Gujarati
Kannada
Kashmiri
Malayalam
Marathi
Oriya
Punjabi
Sanskrit
Tamil
Telugu
Urdu
0 300 MILES
0 300 600 KILOMETERS

## SCRIPTS USED IN THE EIGHTH SCHEDULE LANGUAGES OF INDIA

### SANSKRIT AND SANSKRIT BASED

1 Sanskrit

2 Marathi

3 Hindi

4 Gujarati

5 Punjabi

6 Kashmiri

7 Bengali

8 Assamese

9 Oriya

### DRAVIDIAN BASED

10 Kannada

11 Telugu

12 Tamil

13 Malayalam

### ARABIC BASED

14 Urdu

SOURCE: *Report of The Official Language Commission, 1956*, Government of India, 1957, Delhi: Appendix XIV

## RELIGION

Although Hinduism has been prevalent in India, the "Land of the Hindus" or "Hindustan," for almost 3,500 years, the aboriginal or animist religious groups are even older. The aboriginal religious groups who worship spirits and nature forces are found in hilly and other inaccessible areas which the followers of Hinduism and Islam did not later penetrate.

Hinduism is by far the predominant religion in India. Even before the partition of India in 1947 when most Moslem-dominated areas were formed into the newly created country called Pakistan, as much as three-fourths of the population of British India was Hindu.

Although god figures are numerous and widely worshiped, the major Hindu gods are Vishnu and Siva. In contrast to most other religions, Hinduism lacks a single founder and an organized dogma and hence is tolerant of divergent views and practices. The religion is based upon sacred books, the *Vedas.* Hinduism is a way of life in which *Karma* (a deed or performance of the existing life), is based on *dharma* (a good work or one which conforms to the tenets of the religion); thus, good *karma* enables the individual to achieve salvation without facing the evils of reincarnation. The Aryans who brought Hindu belief from the northwest succeeded in spreading it throughout India. The priest caste, the *Brahmins,* were the main agents of the diffusion of Hinduism, which eventually spread into the Dravidian south.

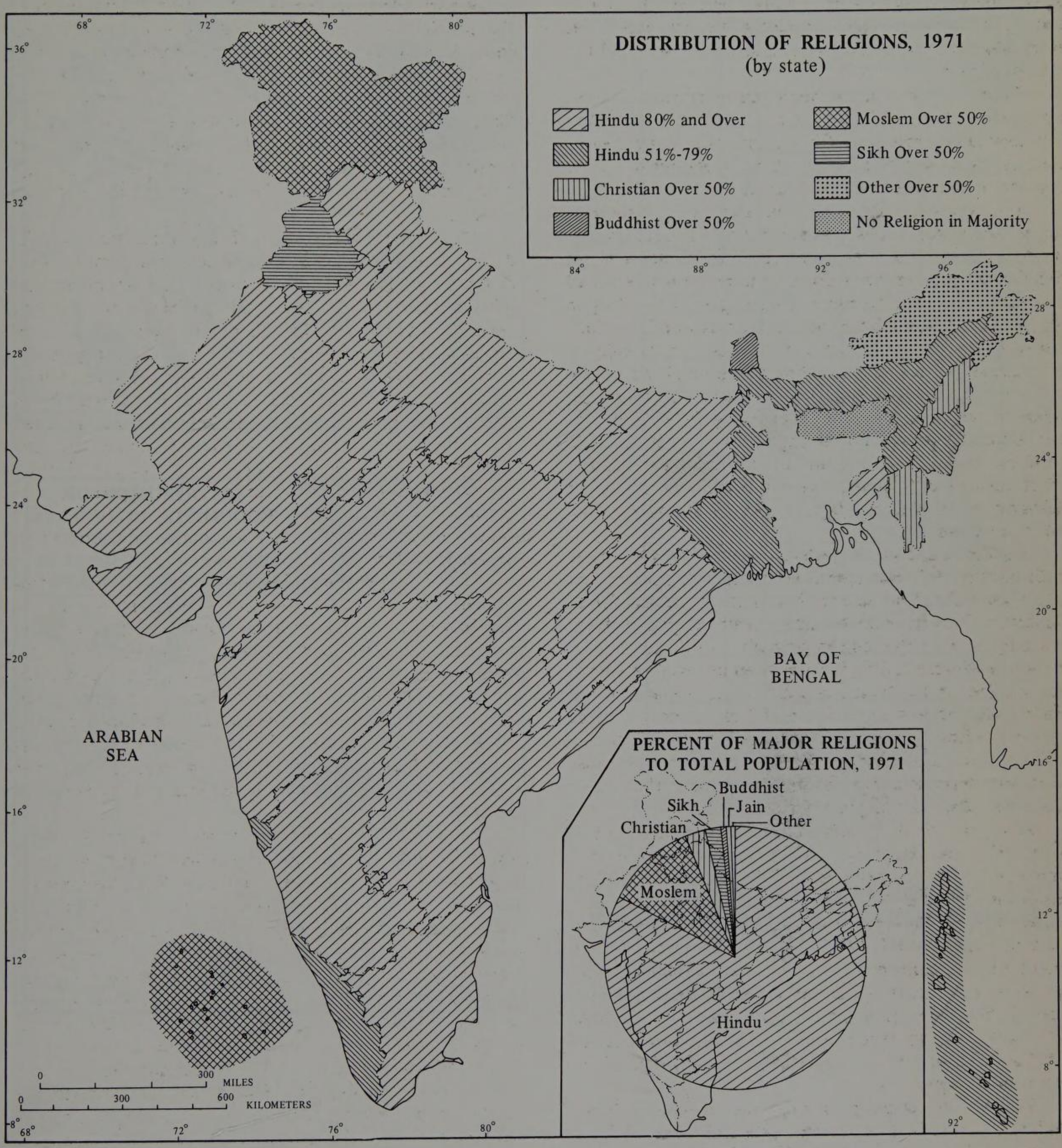
Buddhism and Jainism, which originated in Bihar in the sixth century B.C., also spread widely in India. Originating as protest reform movements, both religions are similar to Hinduism. Jainism never became a main religion in India primarily because the religion prescribes a difficult way of life for its adherents. Still, it is practiced by less than half of one percent of the Indian population, particularly in the central part of western India. Buddhism at one point of history (second century B.C. through fifth/sixth century A.D.) almost superseded Hinduism in importance because of its castelessness and its optimistic outlook. The fanatic Moslem shieks, beginning in 1206, systematically attempted to destroy all visible symbols of every religion excepting Islam. With the destruction of the Buddhist monasteries which had been the main seat of this organized religion, Buddhism eventually lost its remaining popular ground in India. It virtually disappeared from India, but a revival movement led by B.R. Ambedkar in Maharashtra during recent times has augmented the number of followers; still less than one percent of the Indian population is Buddhist. The northern and eastern frontiers of India have considerable Buddhist population because of their closeness to Tibet and Burma, whose people have been long-time adherents of this religion.

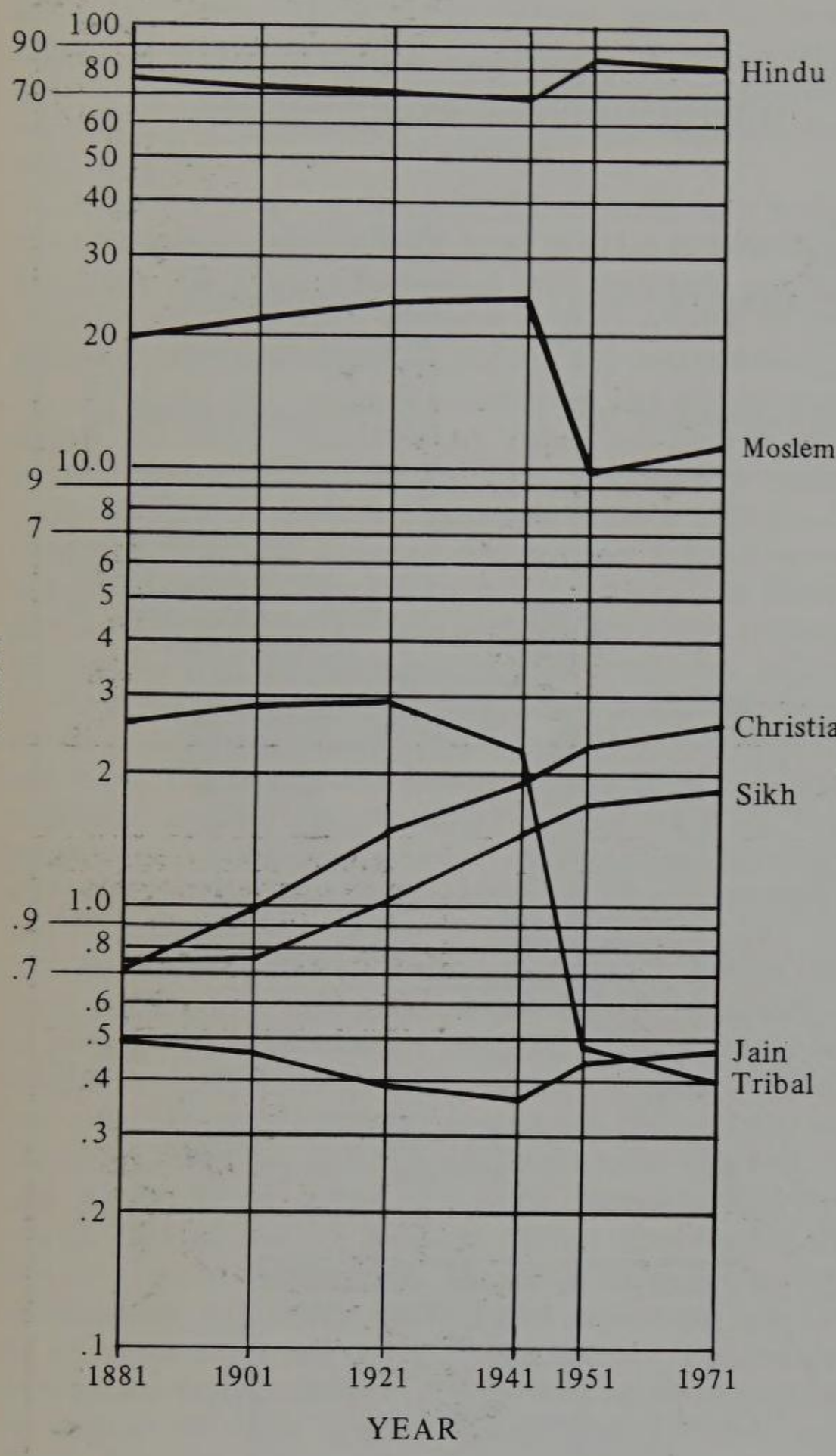
Islam is the second most important religion in India. And since India is a secular state, the followers of Islam practice their religion openly. In fact, the Indian Republic has had two Moslem Presidents. Islam began to gain strength in India from 1206 when Delhi was occupied by Moslem Sultans. Islam, probably the most uncompromising of all the religions, did not have the institution of caste system. The regional impact of the spread of Islam in the subcontinent were (a) the conversion of the Hindus of west India, including Kashmir by force; (b) voluntary conversion of low caste Hindus who had been maltreated by the upper castes particularly in Bengal and Assam; (c) conversion of the peoples of Lakshadweep and the southwestern coast through seaborne contact with the Moslem traders who operated out of the Middle East; (d) conversion of large numbers of Hindus to the Islamic religion in the Ganges Plain, where the effects of Moslem-core areas were direct; and (e) a contiguous stretch of Moslem population in the central Deccan, reflecting the effects of regional Moslem kings, such as the Nizam of Hyderaberd and the Sultan of Mysore.

Christianity, which was probably introduced in India during the third century or even earlier, became more active in the years after Western occupation. The aborigines and other scheduled tribes, who did not have a firmly-based religion, accepted Christianity in large numbers in Nagaland, Meghalaya, Mizoram, and the Chotanagpur Plateau. In Kerala, Goa, and other parts of the south Indian coast, western seaborne contact has caused Christianity to gather a sizeable following. Christianity also was accepted by some socially deprived low-caste Hindus, because through conversion they believed they had gained more status. Moreover, during the western colonial period a large number of Christian males from Europe intermarried with native girls and gave rise to a new community of Christians, the Anglo-Indians.

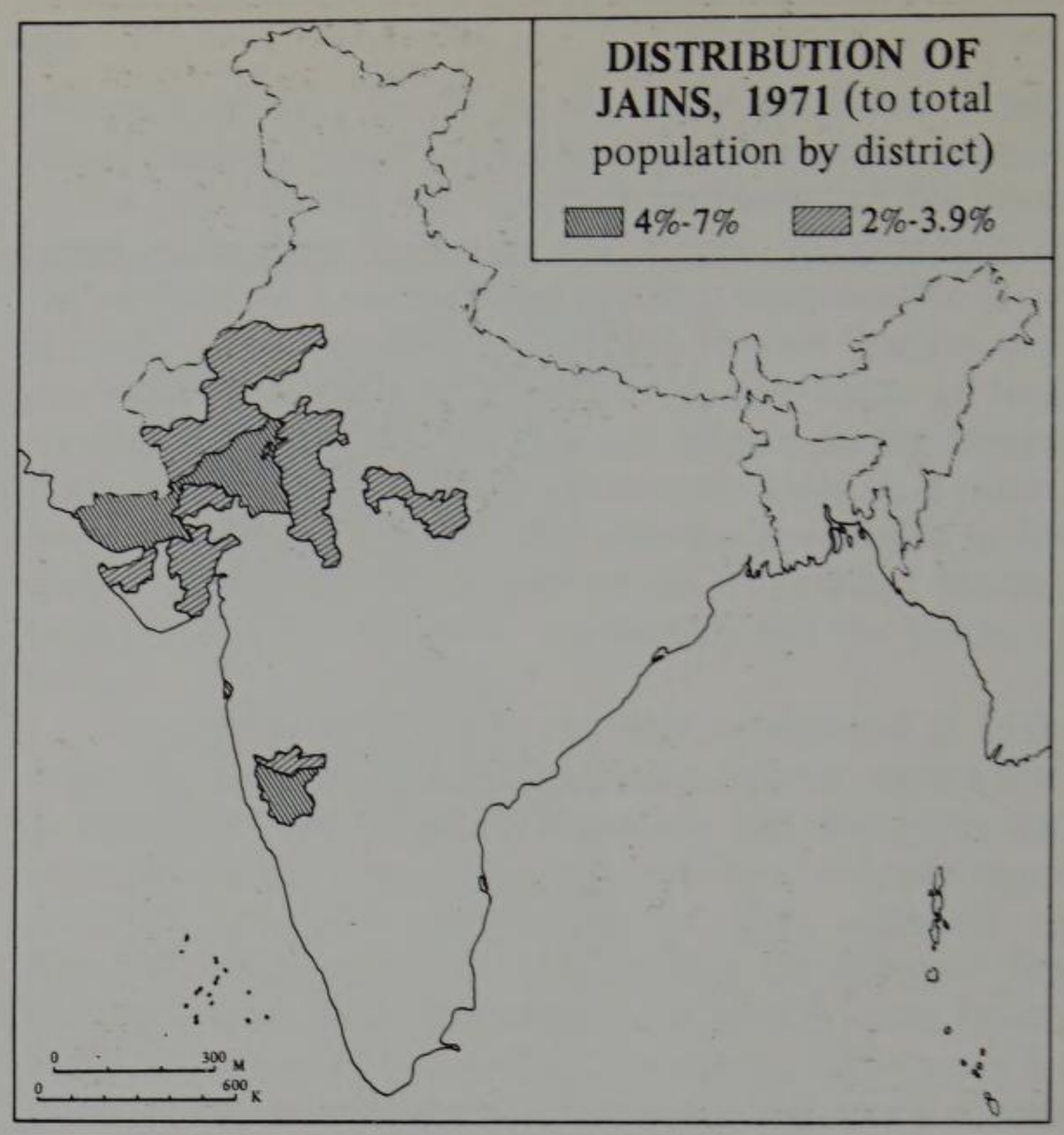
Sikhism, a religion limited mostly to the state of Punjab where it was founded by Guru Nanak in 1499, contains elements of both Hinduism and Islam. Sikhs tend to be more amenable to Hinduism than to Islam because, in historical times, Moslem kings, especially Aurangzeb, persecuted their religion ruthlessly. Parsees are numerically very small, but are an influential and wealthy group of people. They are believers of the Zoroastrian religion, who escaped to India after the Islamic conquest of Persia and settled on the west coast of India, mainly in Gujarat and Bombay.

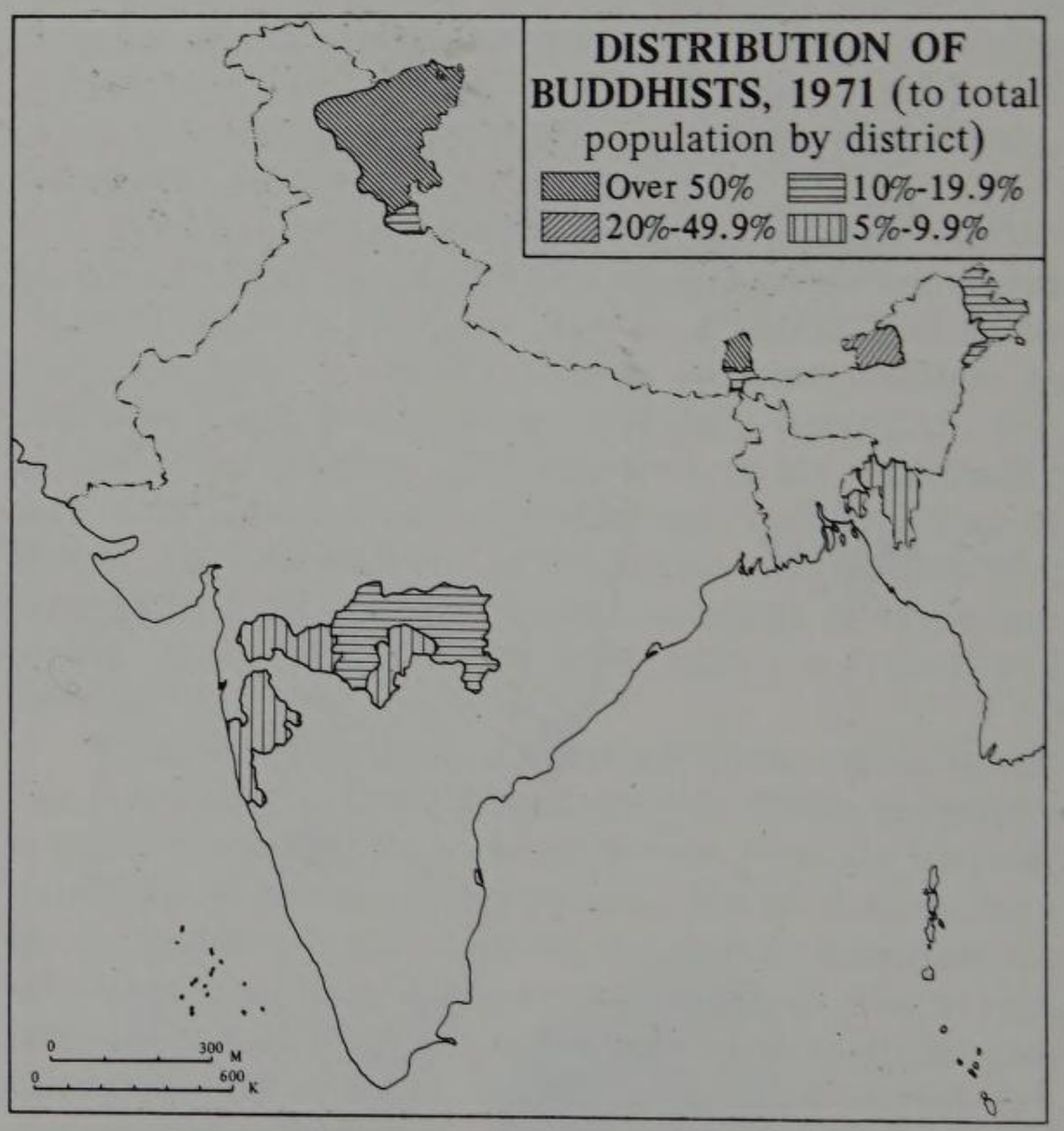
Whatever his religion, the average Indian tends to follow it seriously in belief and in practice. Indian geography is partly responsible for such seriousness. First, the irregular nature of monsoon rains prevented Indian farmers from much needed effective cropping, which is so important for subsistence and thus, dependence on rain gods grew as such irregularity continued generation after generation. Second, calamities such as flood, drought, destructive storms, epidemics, and earthquakes, which occurred regularly in one or more parts of the country could not be checked by human efforts leading to a belief in fate and the god's different ways of punishment. Finally, short life expectancy of the average person in India continued to take a toll of near ones for centuries in spite of the human desire to live through to old age. Such conditions further strengthened beliefs in fatalism. Clinging rigidly to religion in India is a tradition rooted deeply in its geographical environment. Any change in such environment through human efforts, which has already started to take place, will eventually moderate such beliefs.

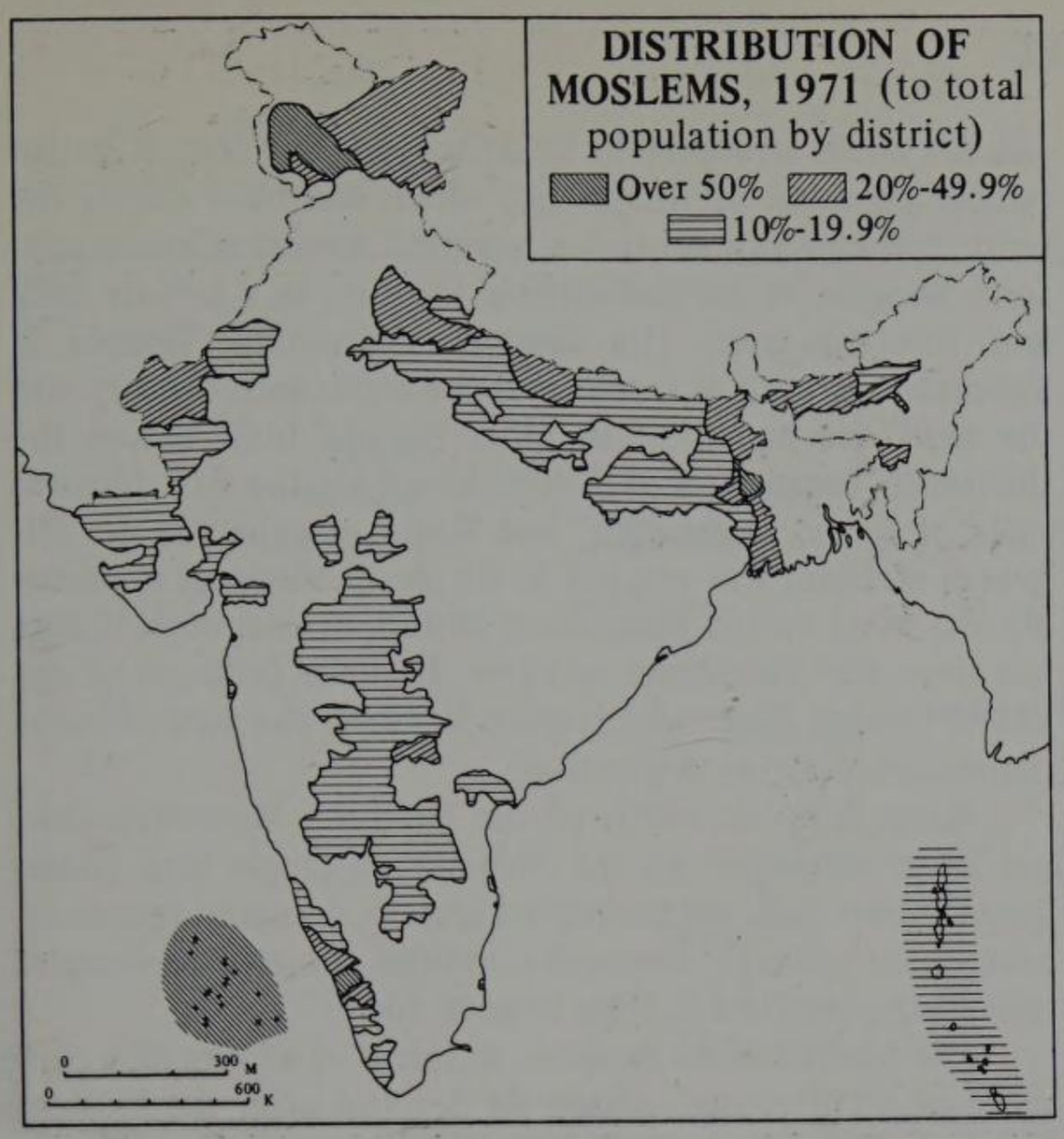

DISTRIBUTION OF RELIGIONS, 1971
(by state)
Hindu 80% and Over
Hindu 51%-79%
Christian Over 50%
Buddhist Over 50%
Moslem Over 50%
Sikh Over 50%
Other Over 50%
No Religion in Majority
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
ARABIAN SEA
BAY OF BENGAL
PERCENT OF MAJOR RELIGIONS TO TOTAL POPULATION, 1971
Buddhist
Sikh
Jain
Other
Christian
Moslem
Hindu
0 300 MILES
0 300 600 KILOMETERS

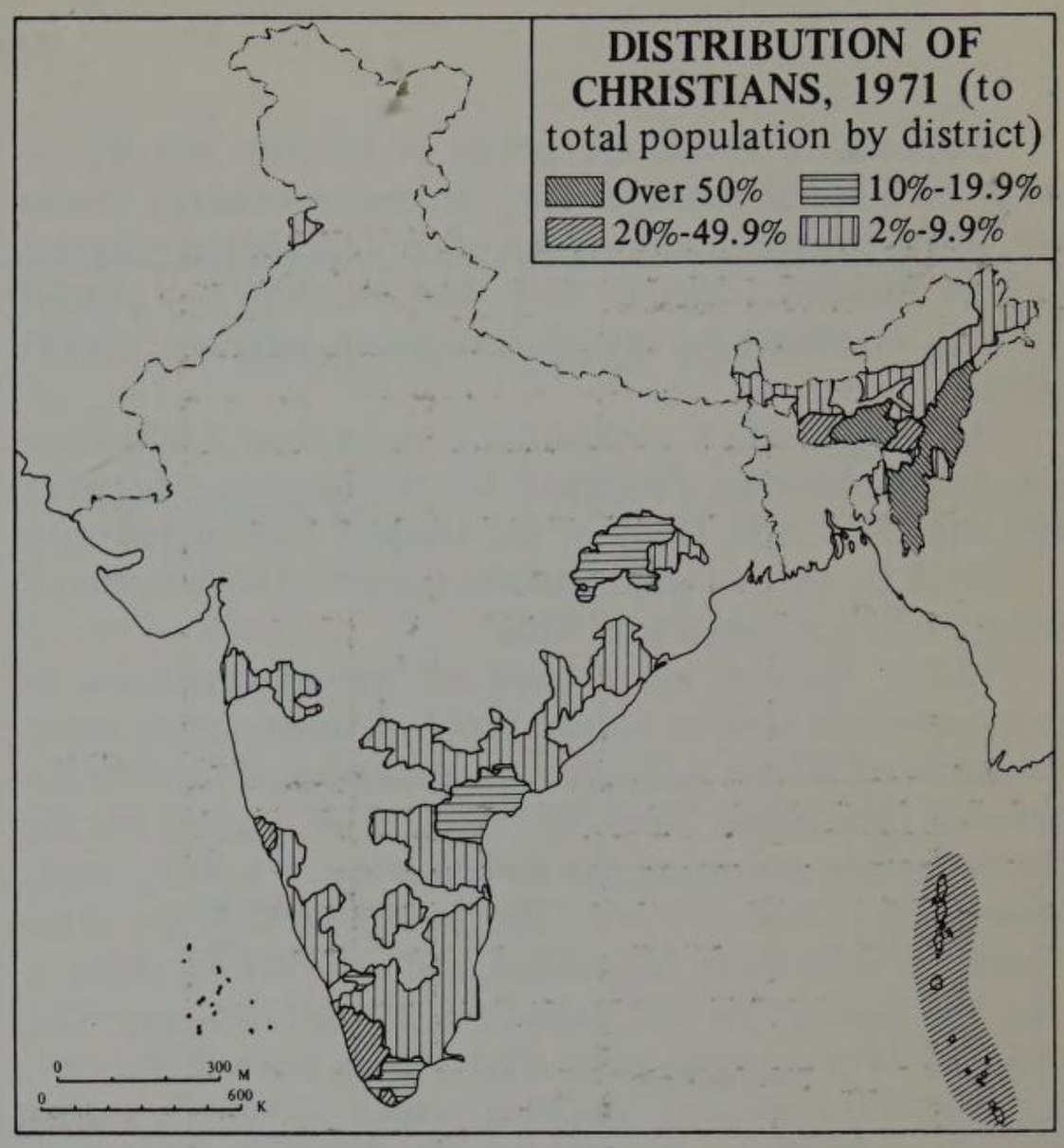


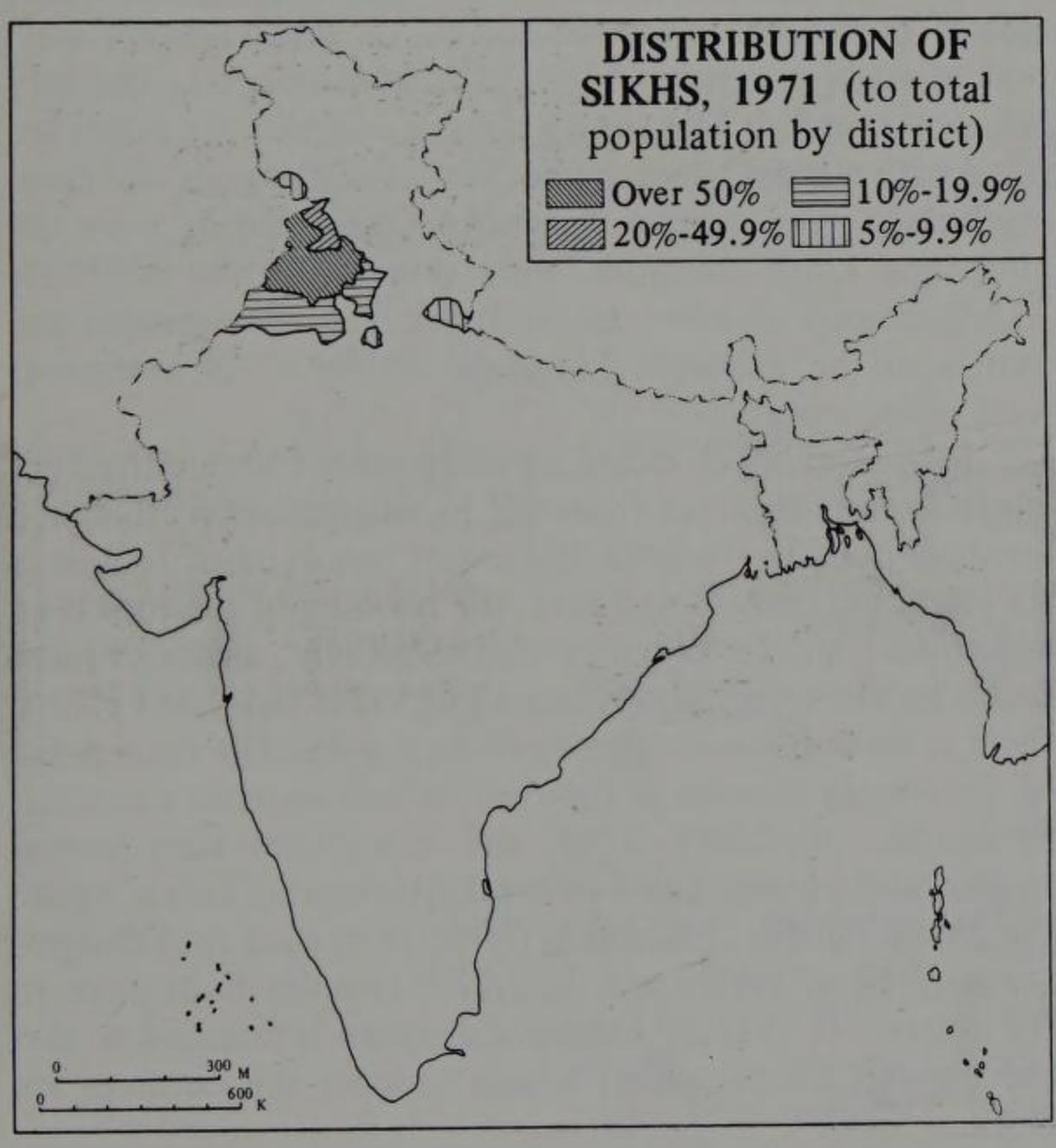

**CHANGE IN COMPOSITION OF INDIAN POPULATION BY RELIGION, 1881-1971**

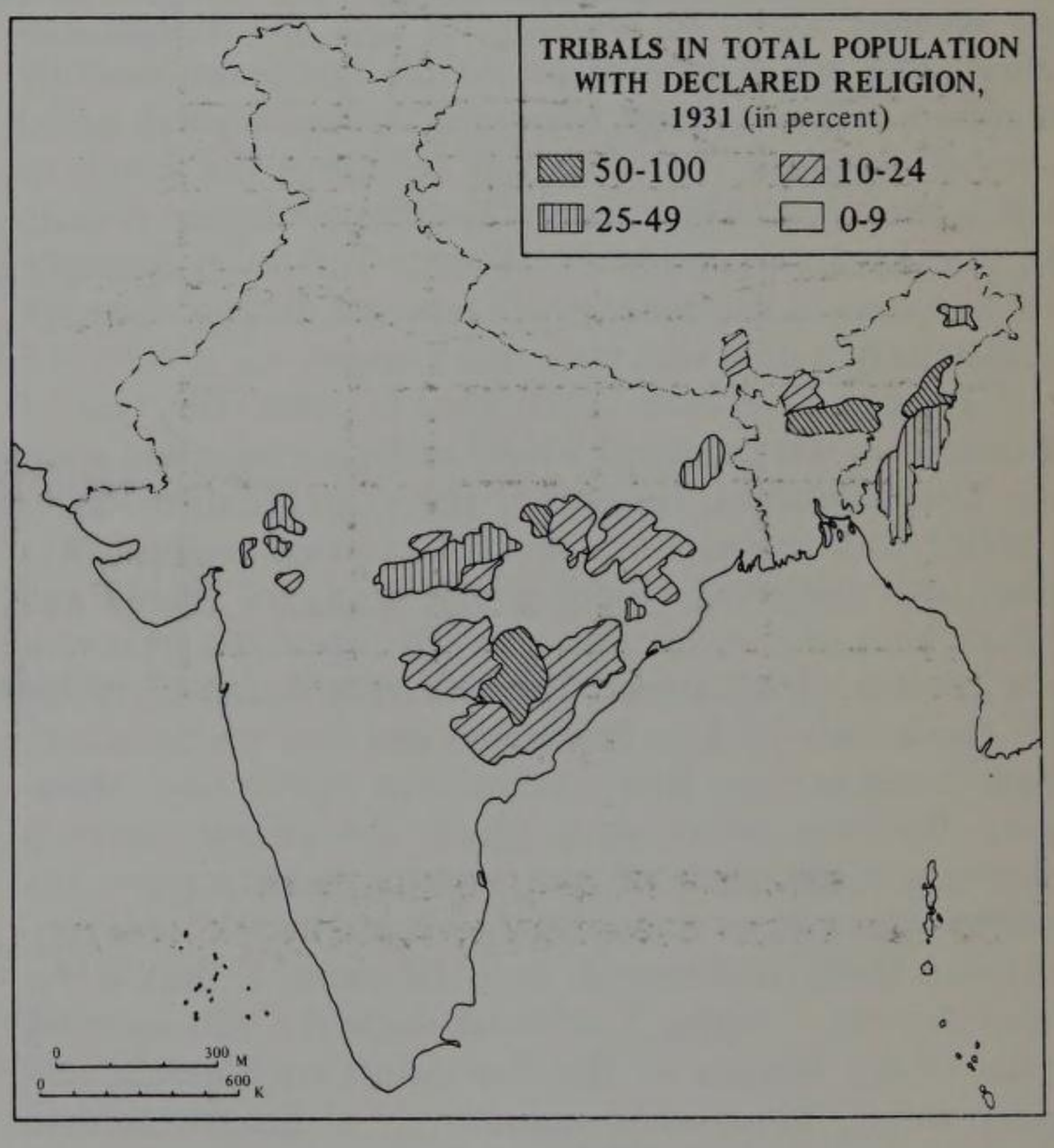



DISTRIBUTION OF MOSLEMS, 1971 (to total population by district)
Over 50%
20%-49.9%
10%-19.9%
0 300 M
0 600 K


DISTRIBUTION OF CHRISTIANS, 1971 (to total population by district)
Over 50%
10%-19.9%
20%-49.9%
2%-9.9%
0 300 M
0 600 K


DISTRIBUTION OF SIKHS, 1971 (to total population by district)
Over 50%
10%-19.9%
20%-49.9%
5%-9.9%
0 300 M
0 600 K


TRIBALS IN TOTAL POPULATION WITH DECLARED RELIGION, 1931 (in percent)
50-100
10-24
25-49
0-9
0 300 M
0 600 K

## HOUSING AND HOUSE TYPES

Housing, one of the three essential necessities of mankind (the other two are food and clothing), is modestly designed and in short supply in India. Standard housing characteristics are thatched roof and mud wall in rural areas, and poorly ventilated, unsanitary, and inadequate tenement spaces in urban areas. Everywhere housing is characterized by overcrowding. According to the 1961 census, 2.58 people shared a room in India as contrasted with an average of 1.5 in developed countries. Estimates made from the same census revealed that the country had a housing shortage of 84 million units.

The rate of population growth has exceeded the slower rate of housing construction with the result that only one or two rooms are available to most families. Overcrowding is higher in more industrialized states; in Maharashtra, West Bengal, and Tamilnadu, over 60% of the households are one-roomed. However, in primarily agricultural states, Punjab and Kerala with 38% and 21% of one-roomed households, respectively, the residential crowding eases. The large metropolises experience the greatest housing congestion. In Calcutta, for example, 67% of the households are one-roomed; in Greater Bombay it is as high as 83%. The National Building Organization Report of 1970 estimated that in Bombay the shortage of housing may be solved if the city builds at least as many units of housing as it has currently. Yet one can always find palatial buildings and aristocratic housing developments in India. Still, they represent only a minute fraction of the nation's buildings. Approximately one-fourth of the country's housing units consist of more than two rooms; only 3% consist of more than six rooms. The contrasts between housing for the rich and the poor are extremely sharp.

*Rural House Materials.* Rural house types in India are not only traditional in nature, but their structure and design conform to environmental demands and to the availability of local building materials. The slope of the roof is invariably related to the amount of rainfall; for example, in rainy Bengal, the roof is conical in shape; in the drier Western Uttar Pradesh the roof is an almost flat top.

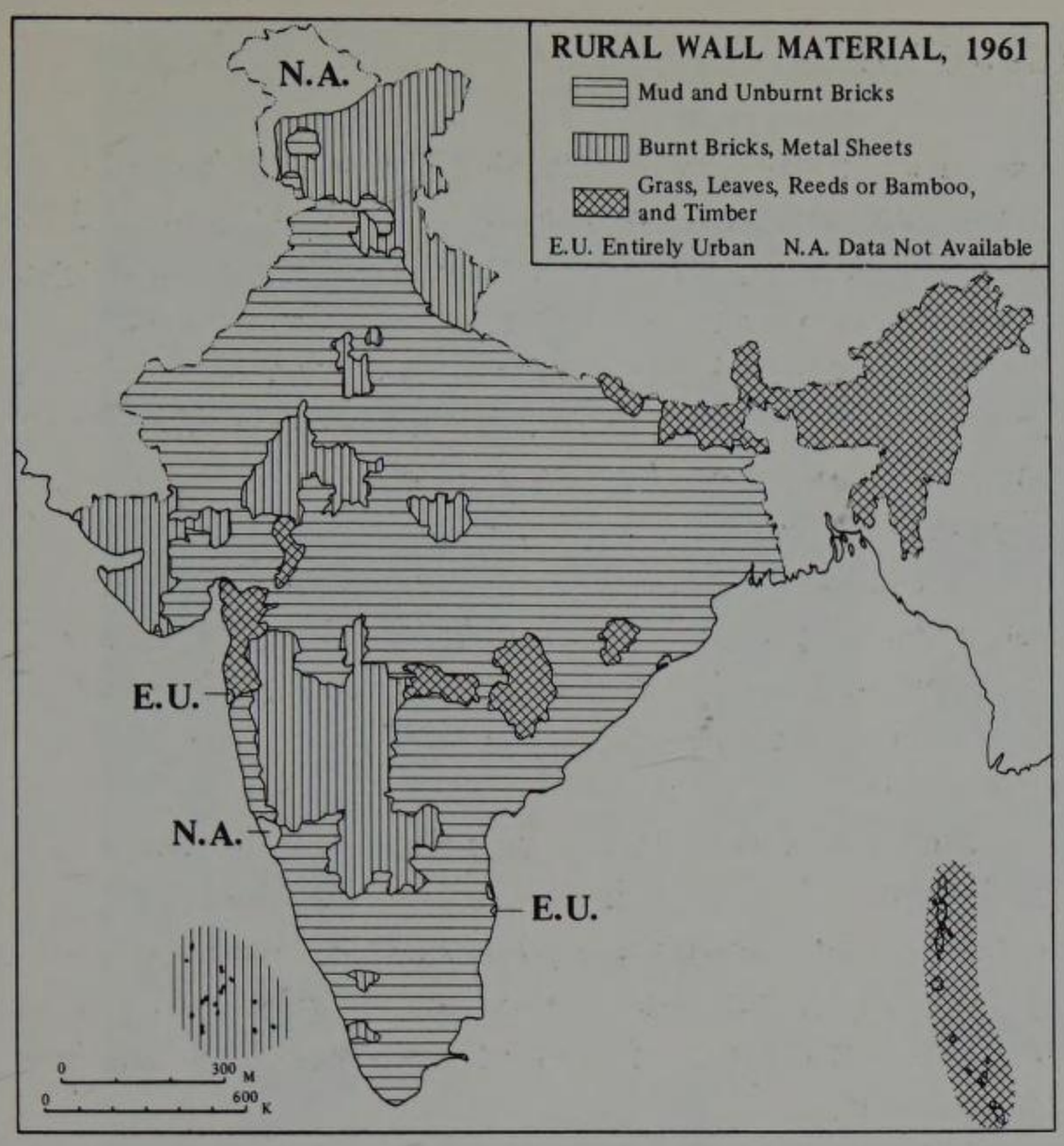
Areas that receive more than 150 cm annual rainfall utilize grass, leaves, reeds, bamboo, or timber for the walls. Grass, leaves, thatchwood, or bamboo are used for roof materials. In areas with rainfall of between 50 and 80 cm per annum and where clay soils are available, mud and unburnt brick comprise the house walls. Tile, slate, shingles, corrugated iron, and so forth are used as roofing materials.

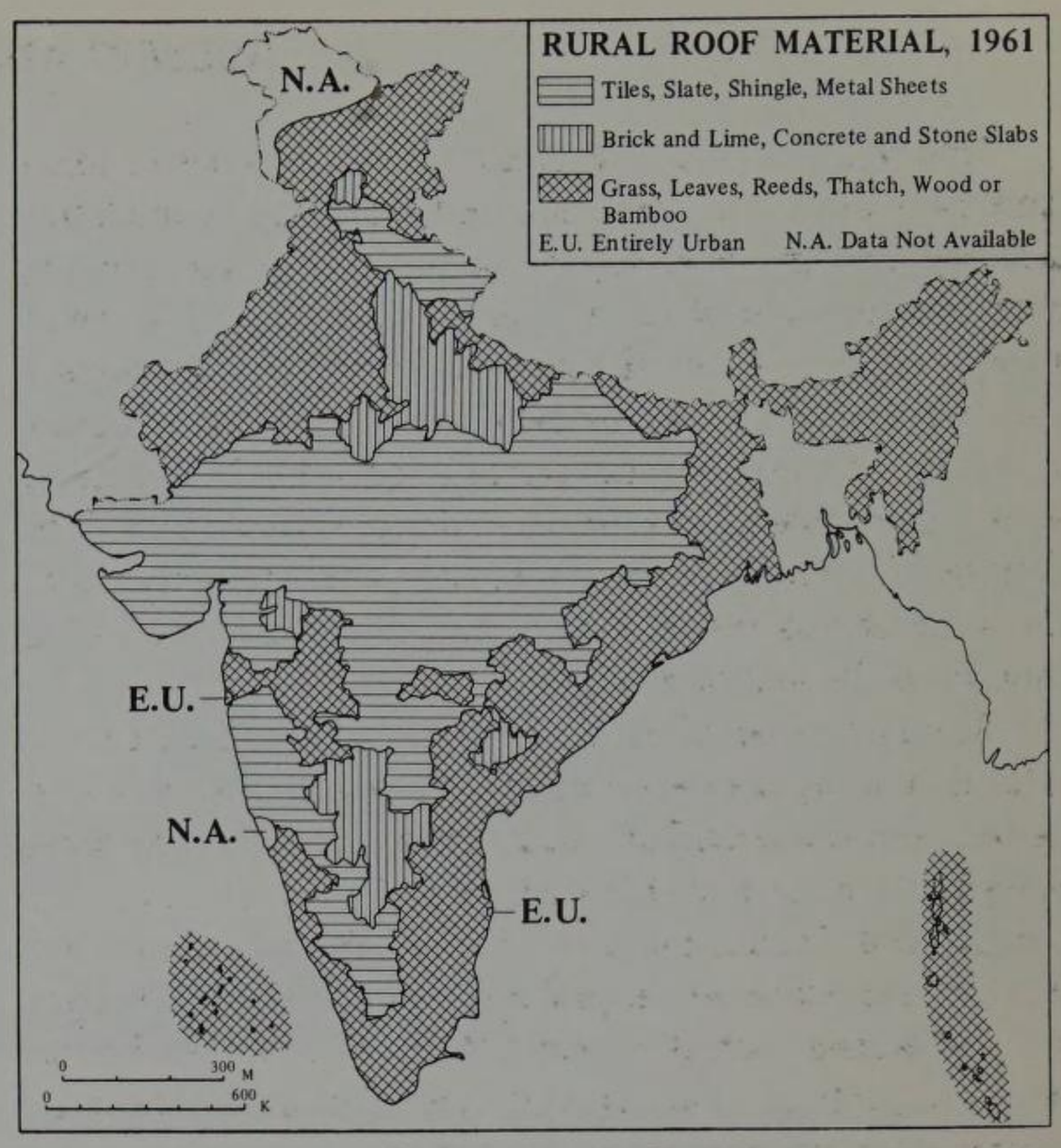
Where bedrock is near or at the earth's surface basalt, granite, and sandstone may provide durable wall materials as in sections of the Deccan Plateau, Kashmir, and Himachal Pradesh.

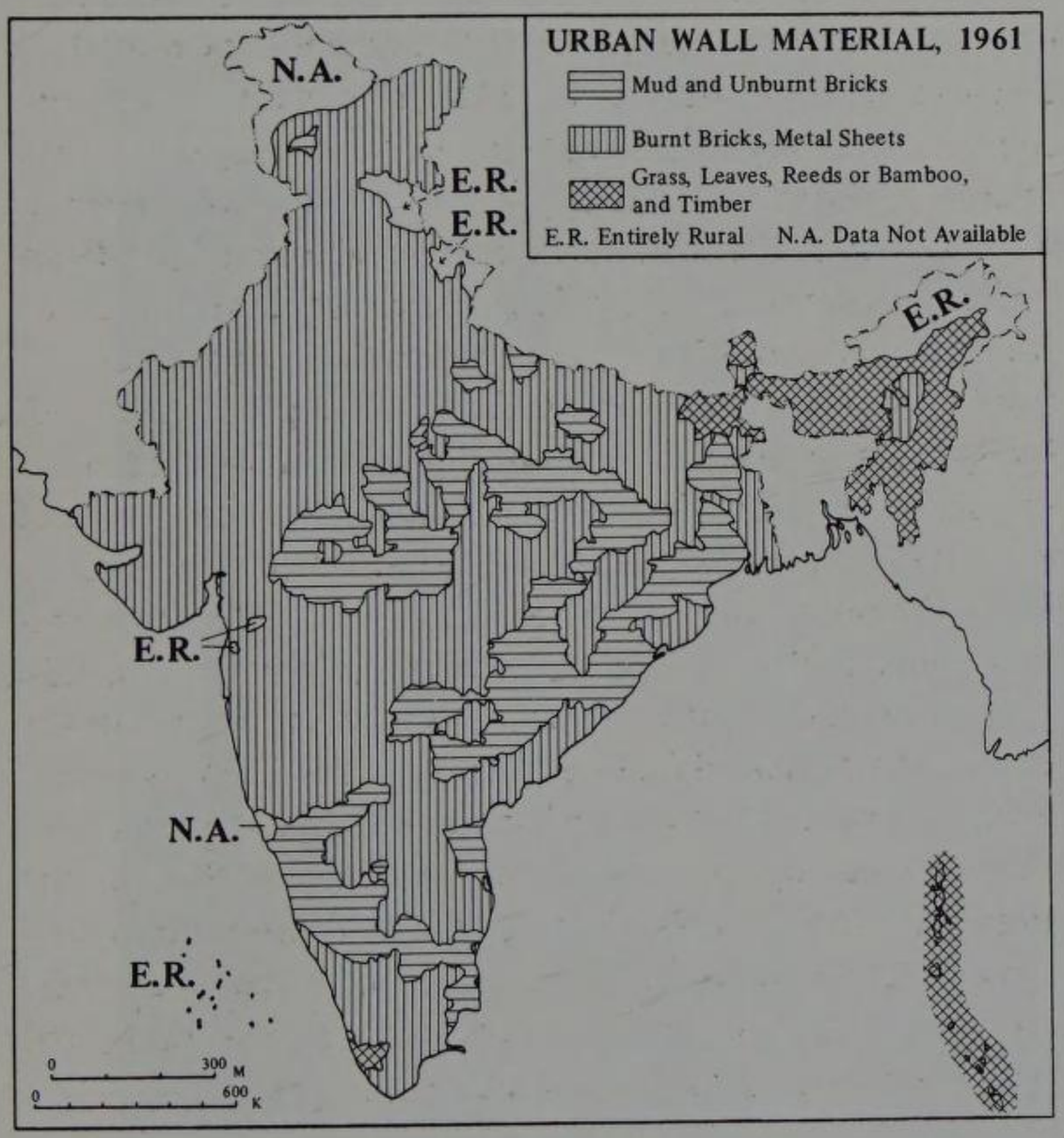
The coastal areas of south India, most of Orissa, and south Bengal provide clay, from local soils, which is used in the construction of mud or unburnt brick walls. Straw from the main agricultural crop, rice, and palm leaves provide roofing materials.

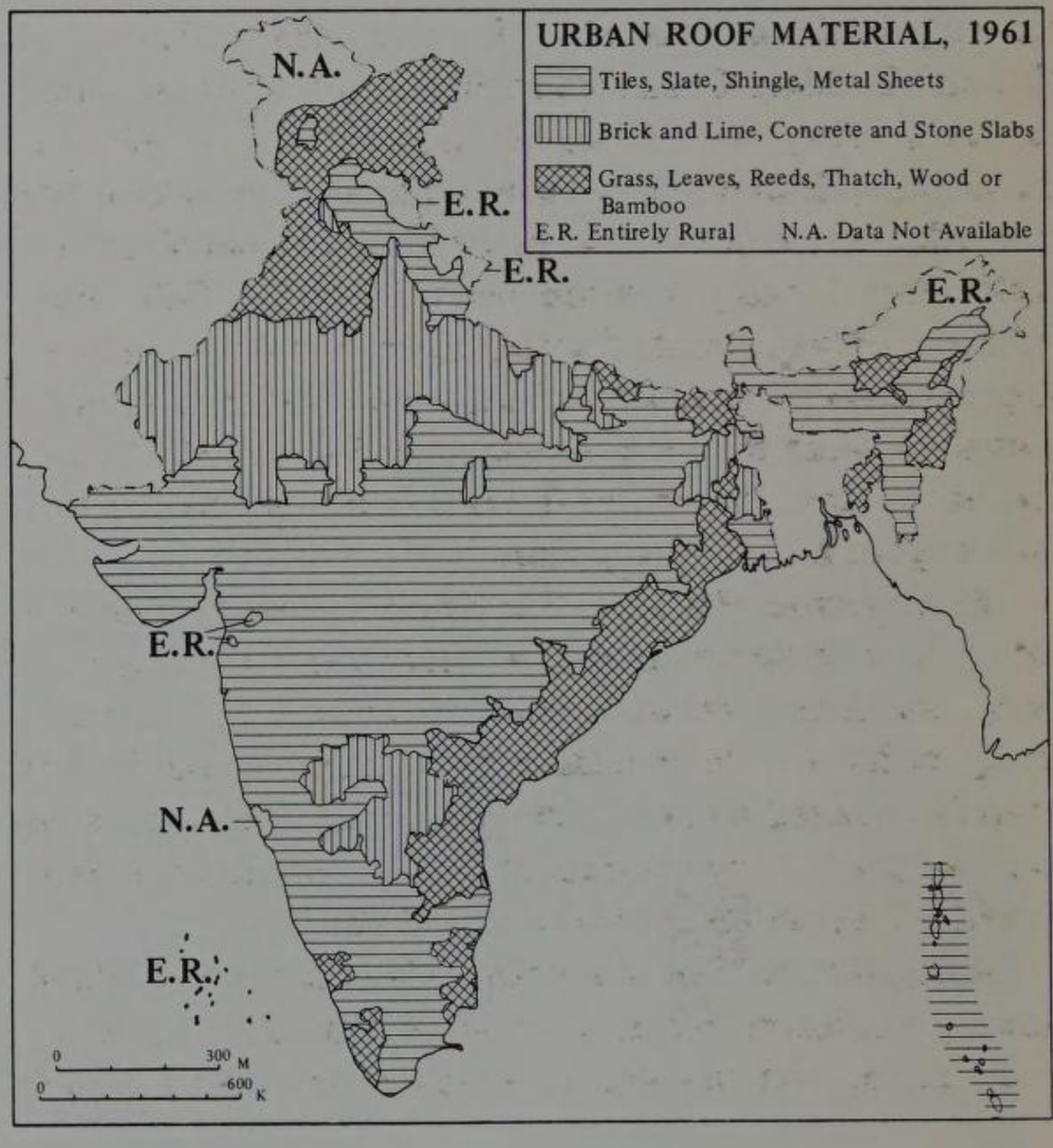
Sunlight is one of the principal factors in orienting one's house. The main living room traditionally faces east so that it will receive the earliest sunrays of the day. Wind system affects the situation of the windows; efforts are made to locate the windows on the windward side for fresh air circulation.

*Urban House Materials.* The impact of modernization has been felt in cities and towns in the form of increasing use of cement as material for walls and roofs of houses; in Calcutta 45% of the roof materials consist of cement-concrete and 84% of the wall material used consist of burnt bricks. In Greater Bombay, 40% of the roof materials is cement-concrete. Nevertheless, availability of local raw materials results in their large-scale use even in urban houses; stone constitutes the roof and wall materials for most houses in cities such as Gwalior, Jaipur, Ajmer, and Jodhpur (all in the northwestern Deccan), where sandstones and slates are plentiful. Over 60% of the wall materials of the houses in Shillong and Gauhati are made up of grass, leaves, bamboo, or timber. Similarly, the cities of Ernakulam and Calicut in Kerala, situated in the high rainfall areas, show a distinctive adjustment to environment in the use of housing materials. Over 65% of the walls in these two cities are made of stone such as granite boulders available from the nearby Western Ghats, but almost 90% of the roofs are made of grass, leaves, thatch, bamboo, tiles, and shingles. These materials are used becaused they are locally available, withstand heavy rains, and because they lend themselves to the traditional slant-roof design.


RURAL WALL MATERIAL, 1961
Mud and Unburnt Bricks
Burnt Bricks, Metal Sheets
Grass, Leaves, Reeds or Bamboo, and Timber
E.U. Entirely Urban N.A. Data Not Available
N.A.
E.U.
N.A.
E.U.
0 300 M
0 600 K


RURAL ROOF MATERIAL, 1961
Tiles, Slate, Shingle, Metal Sheets
Brick and Lime, Concrete and Stone Slabs
Grass, Leaves, Reeds, Thatch, Wood or Bamboo
E.U. Entirely Urban N.A. Data Not Available
N.A.
E.U.
N.A.
E.U.
0 300 M
0 600 K

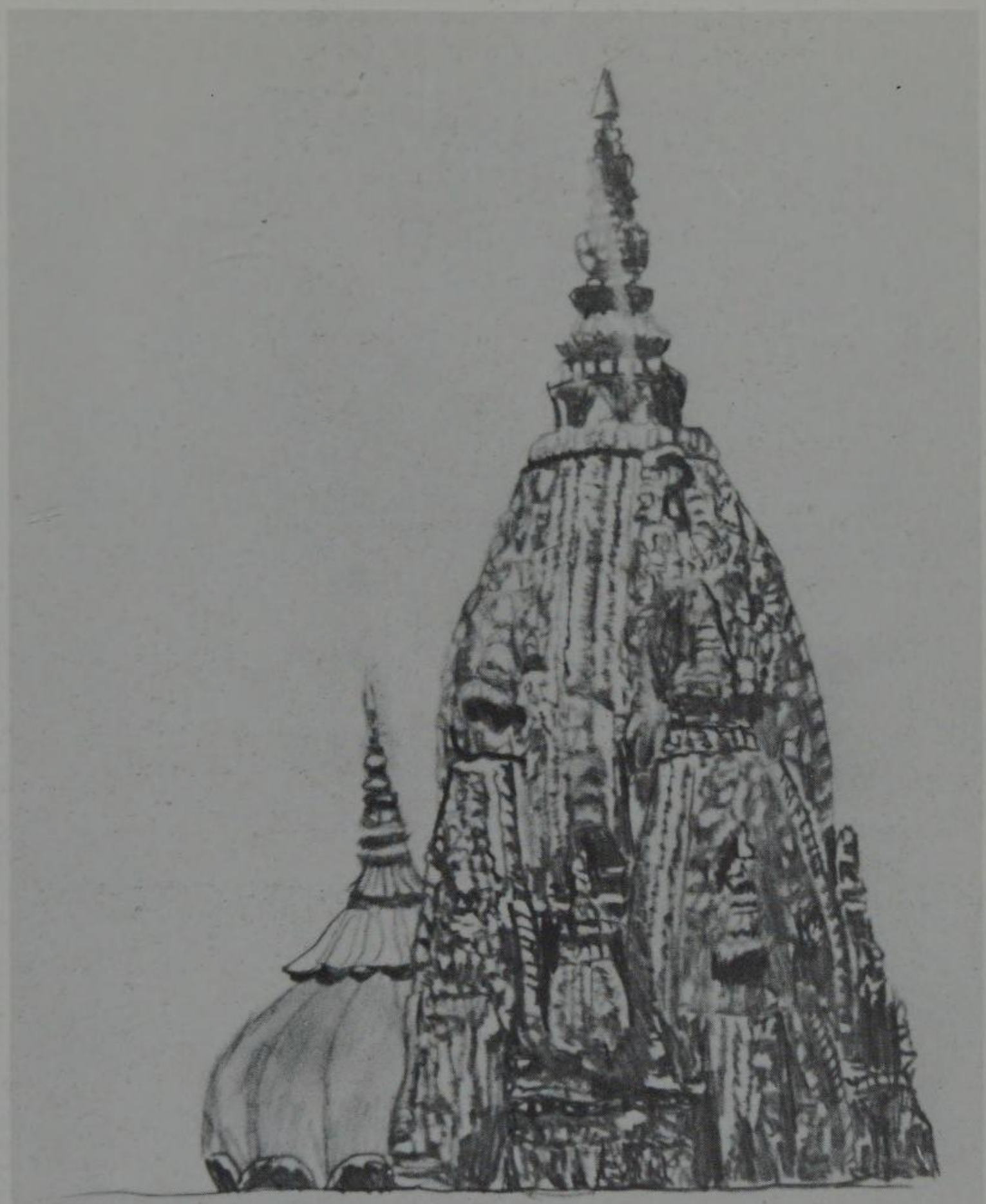

URBAN WALL MATERIAL, 1961
Mud and Unburnt Bricks
Burnt Bricks, Metal Sheets
Grass, Leaves, Reeds or Bamboo, and Timber
E.R. Entirely Rural N.A. Data Not Available
N.A.
E.R.
E.R.
E.R.
E.R.
N.A.
E.R.
0 300 M
0 600 K


URBAN ROOF MATERIAL, 1961
Tiles, Slate, Shingle, Metal Sheets
Brick and Lime, Concrete and Stone Slabs
Grass, Leaves, Reeds, Thatch, Wood or Bamboo
E.R. Entirely Rural N.A. Data Not Available
N.A.
E.R.
E.R.
E.R.
E.R.
N.A.
E.R.
0 300 M
0 600 K

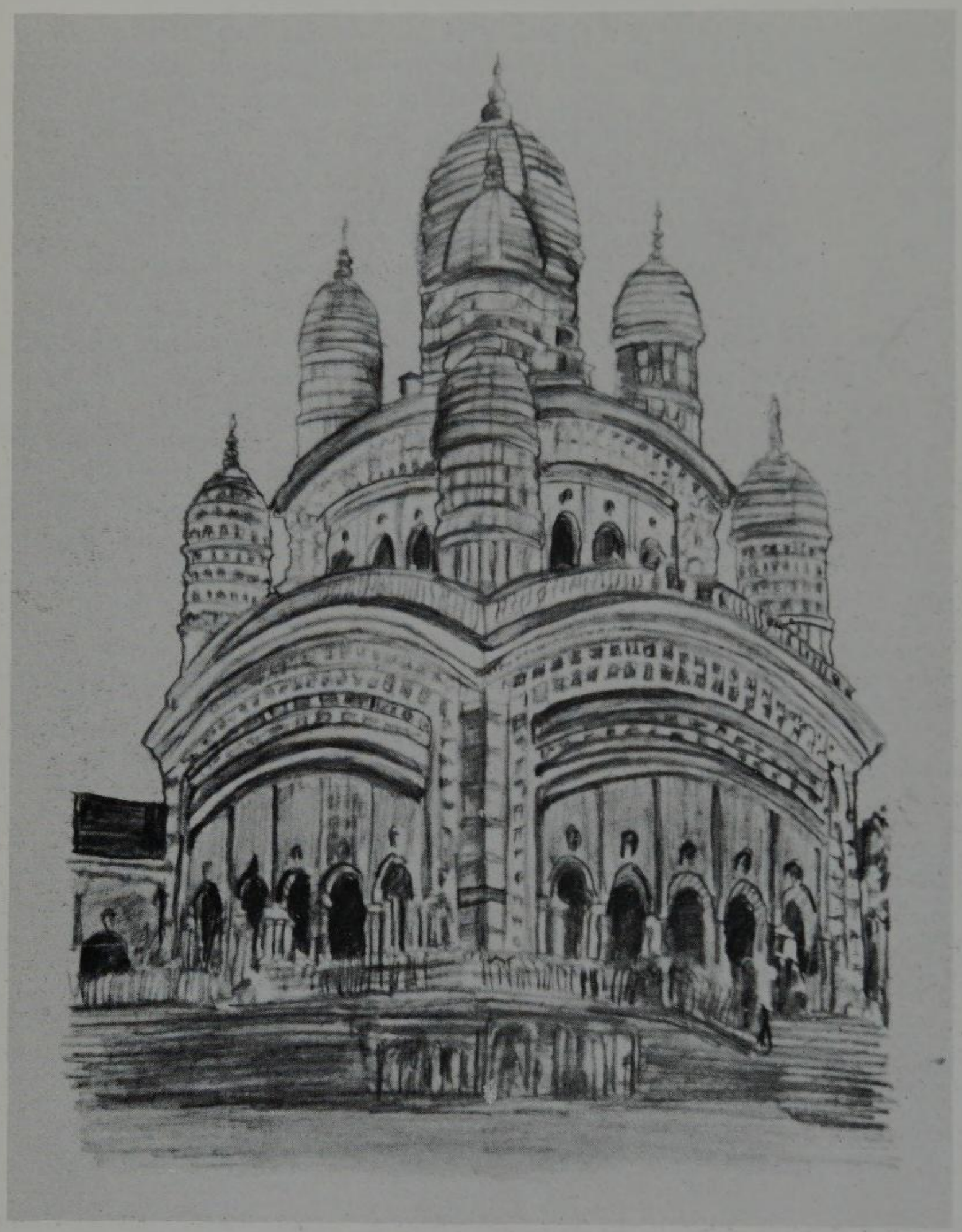
The *Stupa* of Sarnath, near Varanasi, is one of the oldest surviving Buddhist *stupas.* It is here that Buddha preached his first sermon. It is hemispherical in shape and symbolizes Buddha's burial mound. The core of the *stupa* is made of unburnt brick, but the outer wall consists of burnt brick. As the place becomes sacred, monks and learned men started to live near the *stupa,* eventually turning the place into a seat of learning and holy congregation. (Sketch by Jhumku Dutt)

The great Lingaraja temple of Bhubaneswar (Orissa) was built about 1100 A.D. The city of Bhubaneswar is considered sacred because it contained the holy Bhubaneswar Lake, around which was built thousands of shrines; of those about 500 still exist. Lingaraja temple is the most impressive of those shrines. The temple consists of a *Sikhara,* 127' high, constructed without using mortar; in front lies square-shaped and pyramidal roof-designed *mandapa.* The image of Tribhubaneswar (the Lord of Three Worlds) or Lingaraja and Siva *linga* (phallic symbol indicating fertility and creation) are enshrined at different parts of the temple. (Sketch by Rinku Dutt)

One of the gateways to the Ranganatha temple of Srirangam (Tamilnadu), which is the largest Dravidian temple complex. It is situated on an island of the Cauvery River and is famous for the architectural marvels of the seven concentric walls and their gateways, surrounding the main shrine. Within the forewalls of the complex has developed a township, not only consisting of the holy shrine, but also residential quarters and retail stores. The temple enshrines the god *Ranganathar,* which in north India is known as *Vishnu.* (Sketch by Rinku Dutt)

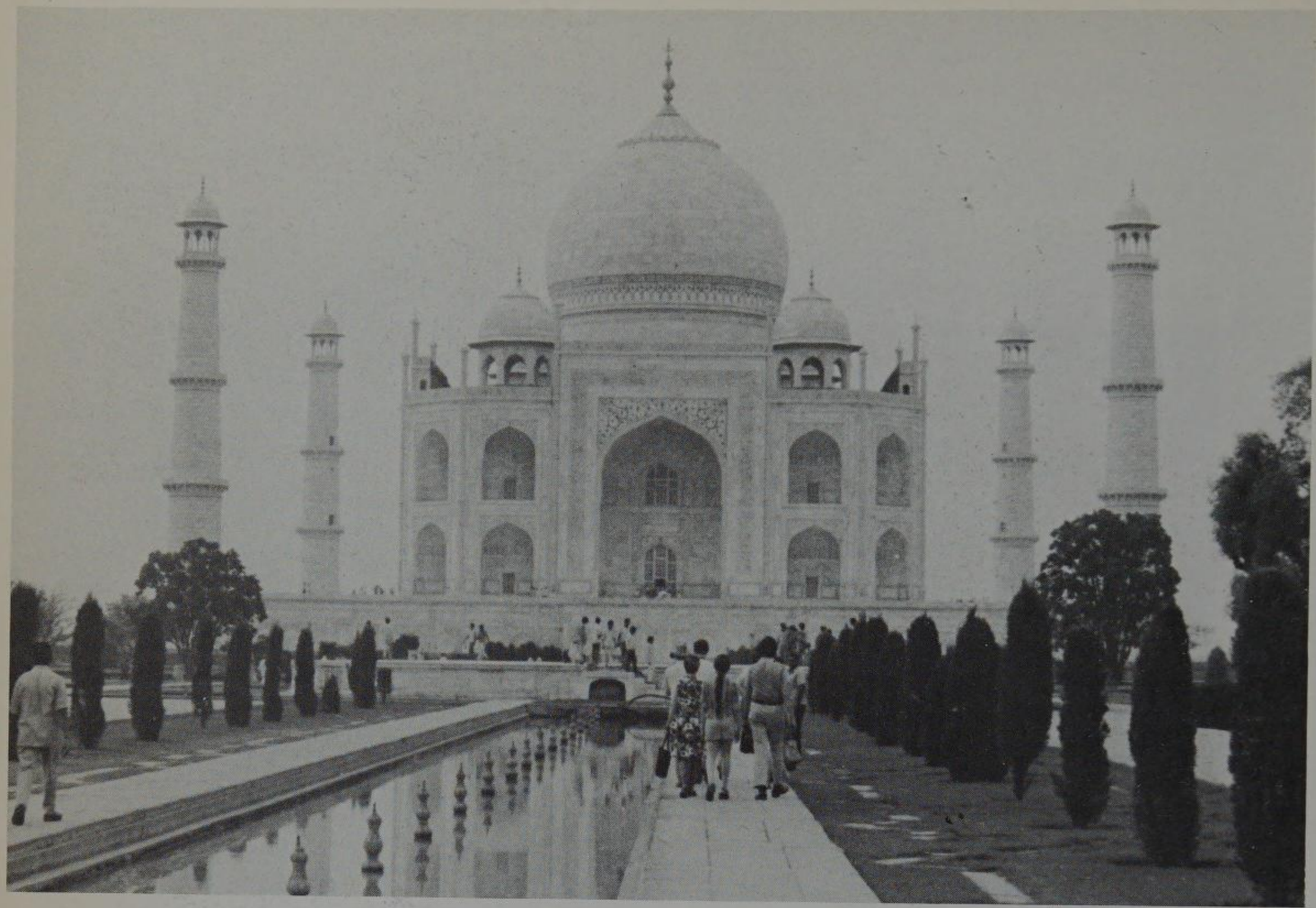


Vishvanath temple of Varanasi, built in the 18th century by Maharani Ahalyabai, is a small structure, but, by virtue of its being the most impressive in the holy city of Varanasi, it is one of the first-order pilgrimage places of India. It is situated by the side of a *ghat* of the Ganges, where the pilgrims take a dip. Orderly symmetric design, gilded copper dome and rich decoration are some of the important characteristics of this temple. One of eighteen *jyotir lingas,* which are supposed to be spread out at different religious places of India, is enshrined in the temple. (Sketch by Jhumku Dutt)



Dakshineswar temple of Calcutta has a folk architectural design from southern Bengal, originating from the local thatched bamboo hut with curved cornice and eave. The temple is situated by the side of the Hooghly River, one of the distributaries of the holy Ganges. The image of *Kali,* the goddess of power, so commonly worshipped in Bengal is enshrined there. Two great saints and spiritual leaders: Ramkrishna Paramhansa and Swami Vivekananda were very closely associated with this temple. This temple is comparatively recently built. (Sketch by Rinku Dutt)

Kerala's indigenous temple style is reflected here by the gabled roof-design, for both the main temple and its protruded entrance. The roof consists of tiles which are made according to processes laid down in the ancient treatises. These processes were probably developed to combat the effects of the heavy monsoon rains. The wall material is of laterite bricks. (Sketch by Jhumku Dutt)



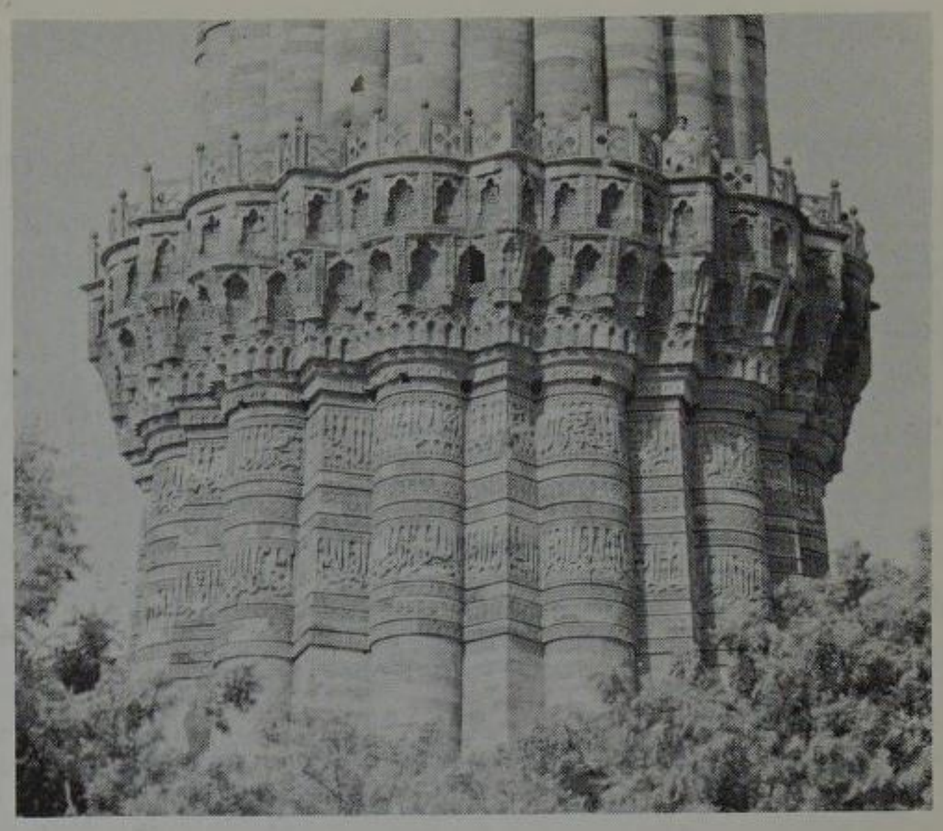
*Taj Mahal,* built by Mogul Emperor Shah Jahan (building time being 1624-48) as a tomb for his beloved wife Mumtaj, is one of the greatest architectural triumphs in the world. (Photo A.K. Dutt)

## FUSION OF INDO-ISLAMIC ART

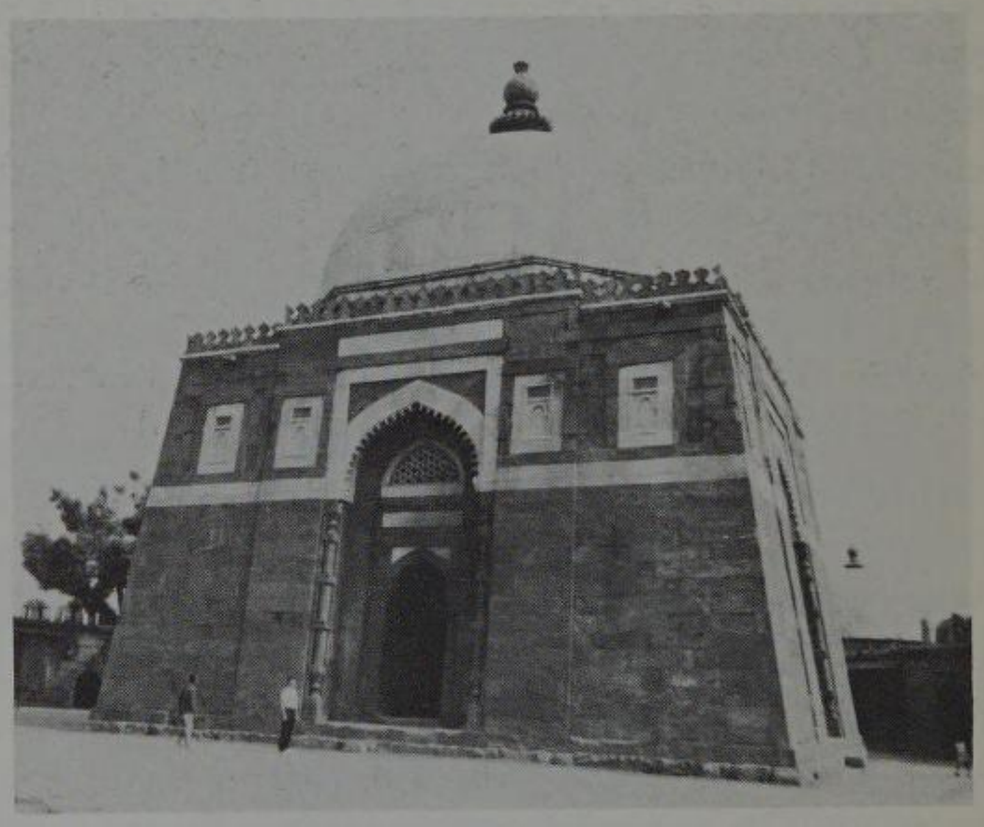
Starting from the time of the Moslem conquest of India, Islamic Art was fused with Indian art forms through a period of transition and adaptation. This art form is known as Indo-Islamic Art, which has been best demonstrated by the tombs, watchtowers, forts, mosques, royal palaces, and courts constructed by the Moslem emperors. All the Moslem emperors of national stature ruled the country from the Agra-Delhi core area, except for a brief span of time in the fourteenth century when Mohammad Tughluq moved his capital to Deogiri at the northern edge of the Deccan Plateau, only to return to Tughlakabad, a few miles from Delhi. The capital sites of the Agra-Delhi region offered the best geo-strategic location for the continentally oriented Moslem rulers. Therefore, most of the remarkable examples of Moslem art forms are found in this core area, though the capitals of the regional Moslem kings, such as Ahmadabad, Golcunda (near Hyderabad), and Srirangapattnam (Karnataka) also witnessed some majestic displays of Moslem architecture. Nonetheless nowhere is this art form so concentrated and chronologically developed as in the Agra-Delhi region.

The most mature stage of the Indo-Islamic art was reached in the seventeenth century; two examples being the *Taj Mahal,* the "pearl of the palace," and *Itimaduddaulah* (both in Agra) where octagonal designs, inlaid decorations on soothing white marble, geometrical symmetry, and minarets at the four corners provide a distinctiveness, which often is referred as Mogul Art of India. Kutub Minar, located in Delhi, built as a watchtower in the form of a minaret, was begun in 1199; the first of the exemplary Indo-Islamic art forms; typical Moslem construction with ornamental decorations executed by the Indian craftsmen. Tughluq tomb of the fourteenth century is typified by a dome, which during the later Moslem times became not only common, but reached its perfection in the elevated dome design of the *Taj Mahal.* However, after the death of Aurangzeb in 1707 Mogul art reached the stage of decadence with the waning power of the Moslem rulers in Delhi. Safderjung tomb in Delhi, built in the eighteenth century, represents this decadence in the form of lesser quality finishings and comparatively inferior elegance.

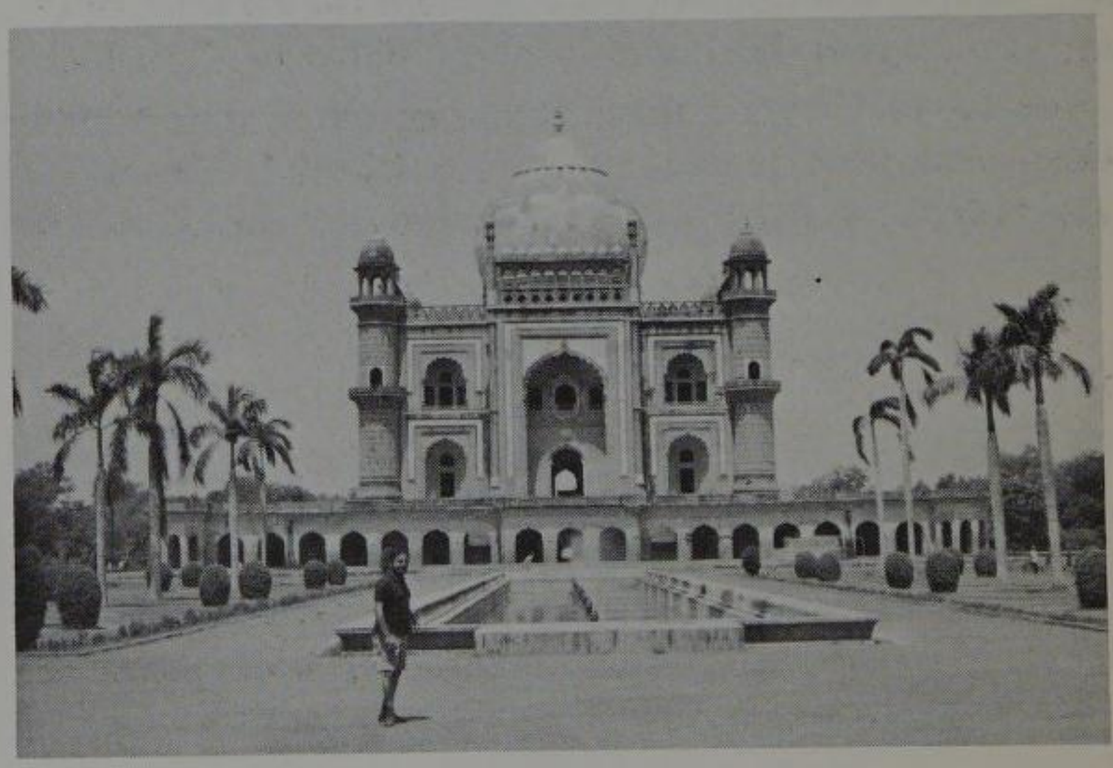
One of the four octagonal minarets of the *Itimaduddaulah,* a tomb dedicated to the father-in-law of the Emperor Jahangir, son of Akbar. Inlaid work on white marble is exquisitely finished. (Photo A.K. Dutt)



The lower part of *Katub Minar,* the construction of which was started by Kutbuddin in 1199, has inscription from the Koran all around its walls; in 1368 and 1503 additions were made; the present height is 238'; it was constructed with locally available red sandstones. (Photo A.K. Dutt)



Tughluq Tombs with slightly slanted walls. (Photo A.K. Dutt)



Safderjung Tomb in Delhi. (Photo A.K. Dutt)

## HOUSING AND HOUSE TYPES

Housing, one of the three essential necessities of mankind (the other two are food and clothing), is modestly designed and in short supply in India. Standard housing characteristics are thatched roof and mud wall in rural areas, and poorly ventilated, unsanitary, and inadequate tenement spaces in urban areas. Everywhere housing is characterized by overcrowding. According to the 1961 census, 2.58 people shared a room in India as contrasted with an average of 1.5 in developed countries. Estimates made from the same census revealed that the country had a housing shortage of 84 million units.

The rate of population growth has exceeded the slower rate of housing construction with the result that only one or two rooms are available to most families. Overcrowding is higher in more industrialized states; in Maharashtra, West Bengal, and Tamilnadu, over 60% of the households are one-roomed. However, in primarily agricultural states, Punjab and Kerala with 38% and 21% of one-roomed households, respectively, the residential crowding eases. The large metropolises experience the greatest housing congestion. In Calcutta, for example, 67% of the households are one-roomed; in Greater Bombay it is as high as 83%. The National Building Organization Report of 1970 estimated that in Bombay the shortage of housing may be solved if the city builds at least as many units of housing as it has currently. Yet one can always find palatial buildings and aristocratic housing developments in India. Still, they represent only a minute fraction of the nation's buildings. Approximately one-fourth of the country's housing units consist of more than two rooms; only 3% consist of more than six rooms. The contrasts between housing for the rich and the poor are extremely sharp.

*Rural House Materials.* Rural house types in India are not only traditional in nature, but their structure and design conform to environmental demands and to the availability of local building materials. The slope of the roof is invariably related to the amount of rainfall; for example, in rainy Bengal, the roof is conical in shape; in the drier Western Uttar Pradesh the roof is an almost flat top.

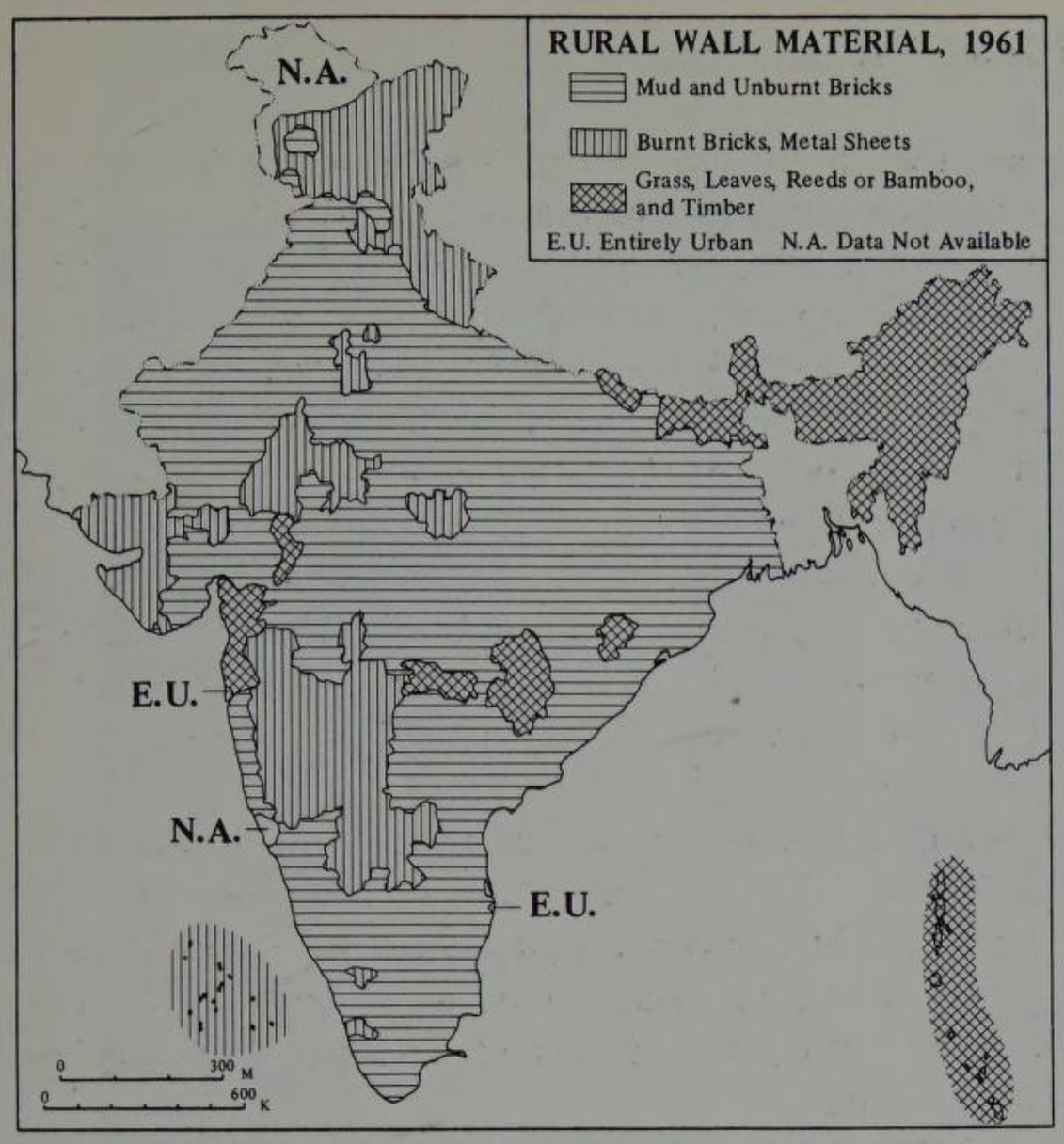
Areas that receive more than 150 cm annual rainfall utilize grass, leaves, reeds, bamboo, or timber for the walls. Grass, leaves, thatchwood, or bamboo are used for roof materials. In areas with rainfall of between 50 and 80 cm per annum and where clay soils are available, mud and unburnt brick comprise the house walls. Tile, slate, shingles, corrugated iron, and so forth are used as roofing materials.

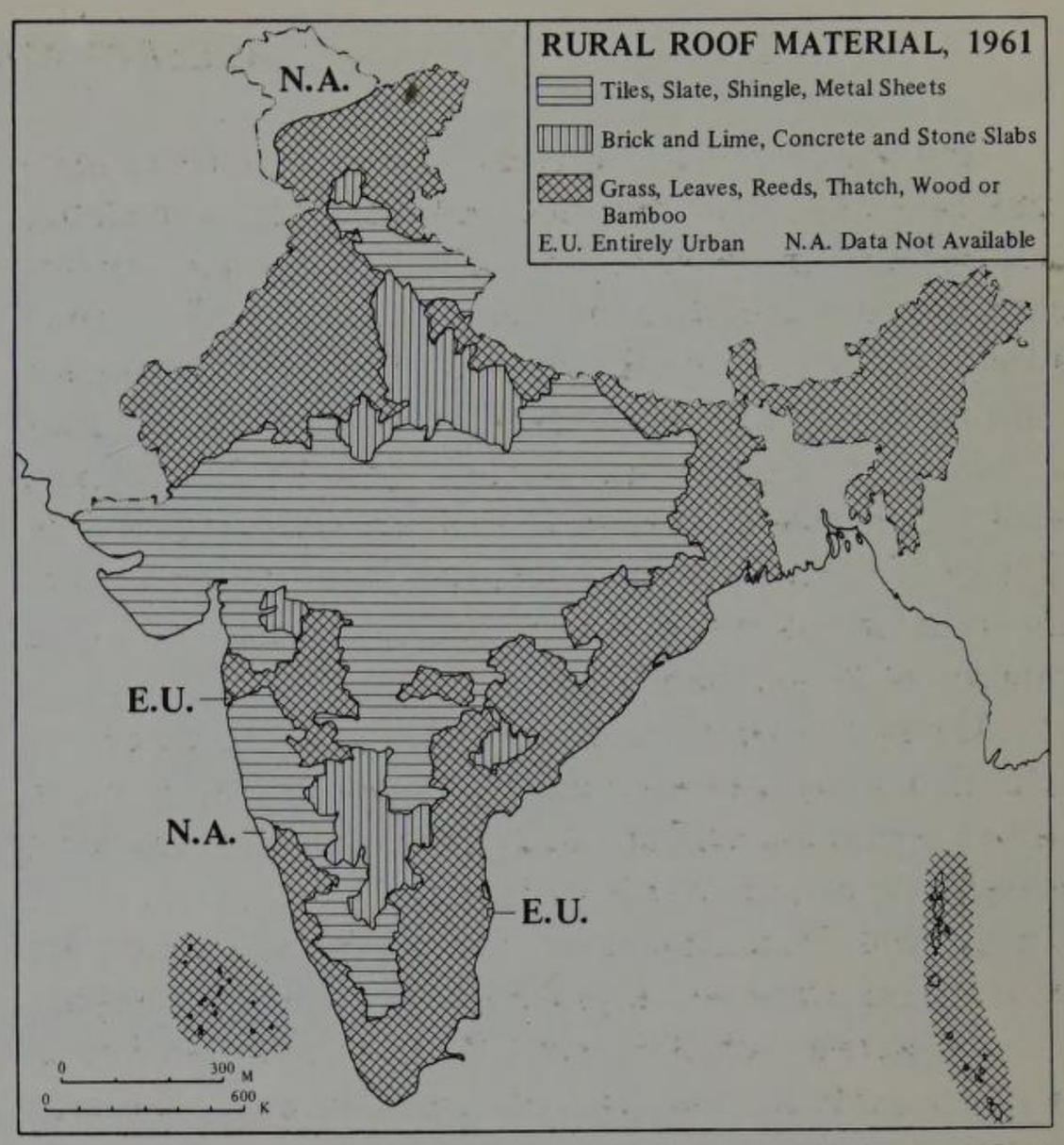
Where bedrock is near or at the earth's surface basalt, granite, and sandstone may provide durable wall materials as in sections of the Deccan Plateau, Kashmir, and Himachal Pradesh.

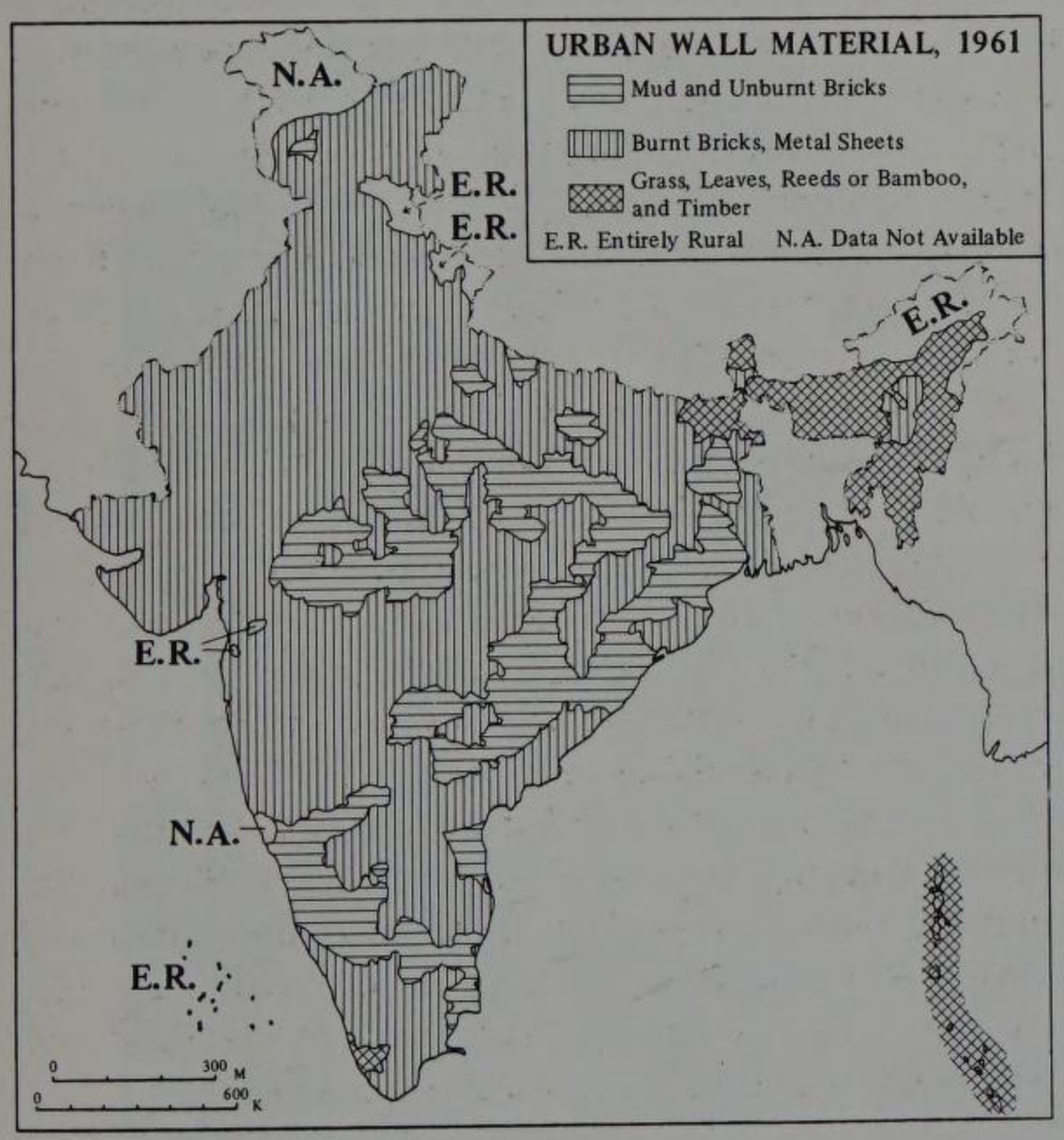
The coastal areas of south India, most of Orissa, and south Bengal provide clay, from local soils, which is used in the construction of mud or unburnt brick walls. Straw from the main agricultural crop, rice, and palm leaves provide roofing materials.

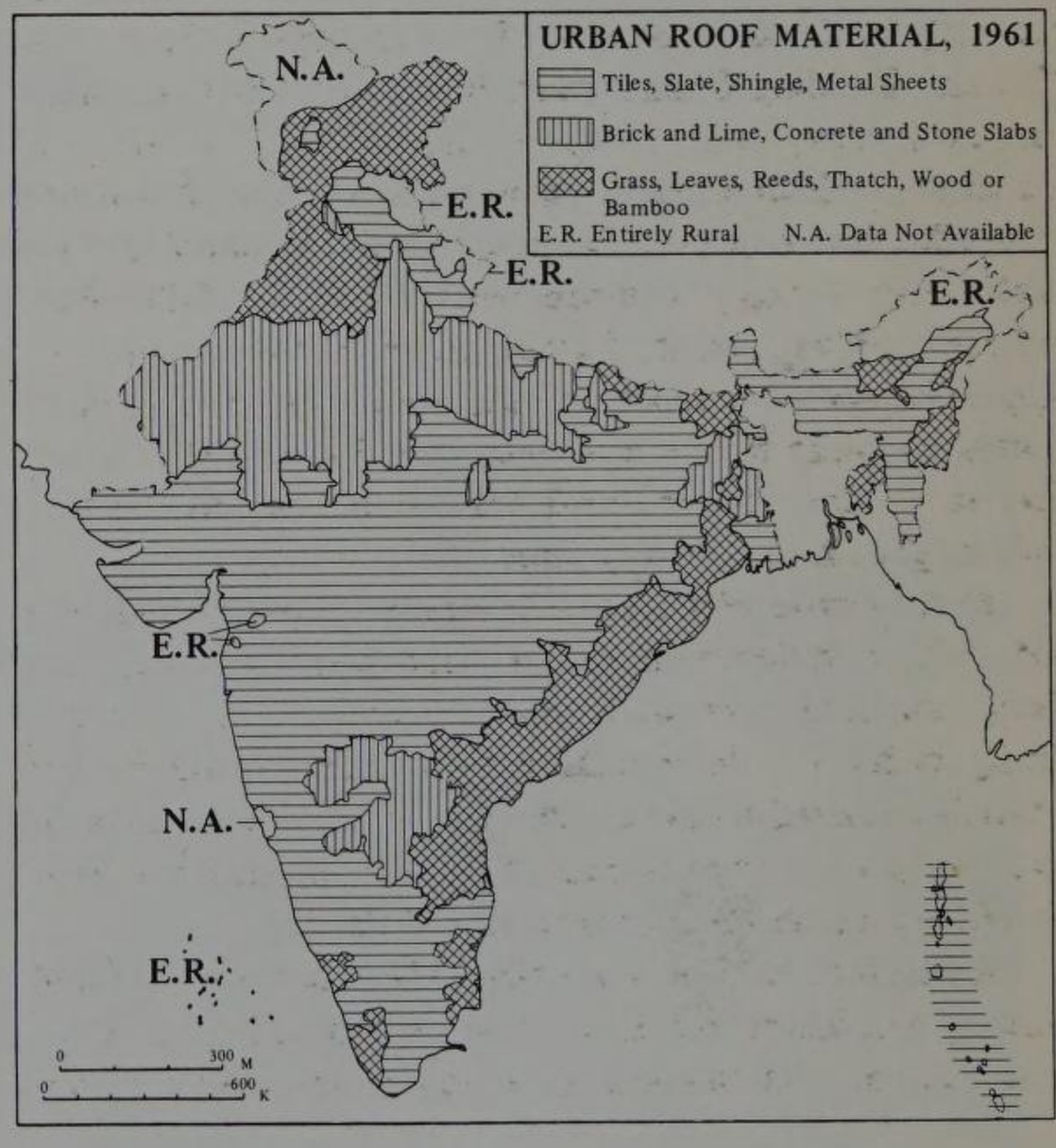
Sunlight is one of the principal factors in orienting one's house. The main living room traditionally faces east so that it will receive the earliest sunrays of the day. Wind system affects the situation of the windows; efforts are made to locate the windows on the windward side for fresh air circulation.

*Urban House Materials.* The impact of modernization has been felt in cities and towns in the form of increasing use of cement as material for walls and roofs of houses; in Calcutta 45% of the roof materials consist of cement-concrete and 84% of the wall material used consist of burnt bricks. In Greater Bombay, 40% of the roof materials is cement-concrete. Nevertheless, availability of local raw materials results in their large-scale use even in urban houses; stone constitutes the roof and wall materials for most houses in cities such as Gwalior, Jaipur, Ajmer, and Jodhpur (all in the northwestern Deccan), where sandstones and slates are plentiful. Over 60% of the wall materials of the houses in Shillong and Gauhati are made up of grass, leaves, bamboo, or timber. Similarly, the cities of Ernakulam and Calicut in Kerala, situated in the high rainfall areas, show a distinctive adjustment to environment in the use of housing materials. Over 65% of the walls in these two cities are made of stone such as granite boulders available from the nearby Western Ghats, but almost 90% of the roofs are made of grass, leaves, thatch, bamboo, tiles, and shingles. These materials are used becaused they are locally available, withstand heavy rains, and because they lend themselves to the traditional slant-roof design.


RURAL WALL MATERIAL, 1961
Mud and Unburnt Bricks
Burnt Bricks, Metal Sheets
Grass, Leaves, Reeds or Bamboo, and Timber
E.U. Entirely Urban N.A. Data Not Available
N.A.
E.U.
N.A.
E.U.
0 300 M
0 600 K

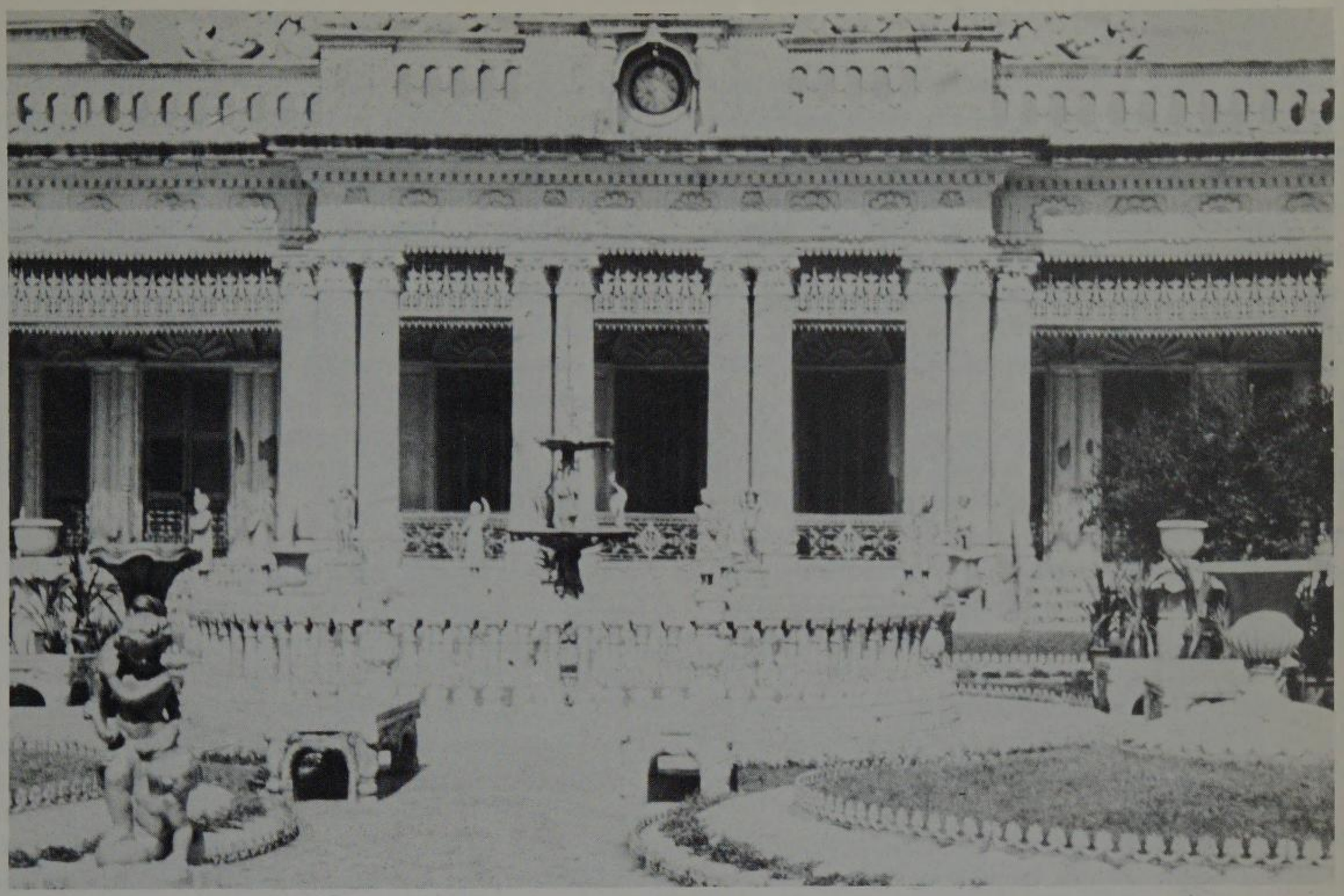

RURAL ROOF MATERIAL, 1961
Tiles, Slate, Shingle, Metal Sheets
Brick and Lime, Concrete and Stone Slabs
Grass, Leaves, Reeds, Thatch, Wood or Bamboo
E.U. Entirely Urban N.A. Data Not Available
N.A.
E.U.
N.A.
E.U.
0 300 M
0 600 K


URBAN WALL MATERIAL, 1961
Mud and Unburnt Bricks
Burnt Bricks, Metal Sheets
Grass, Leaves, Reeds or Bamboo, and Timber
E.R. Entirely Rural N.A. Data Not Available
N.A.
E.R.
E.R.
E.R.
E.R.
N.A.
E.R.
0 300 M
0 600 K


URBAN ROOF MATERIAL, 1961
Tiles, Slate, Shingle, Metal Sheets
Brick and Lime, Concrete and Stone Slabs
Grass, Leaves, Reeds, Thatch, Wood or Bamboo
E.R. Entirely Rural N.A. Data Not Available
N.A.
E.R.
E.R.
E.R.
E.R.
N.A.
E.R.
0 300 M
0 600 K

A roof-frame, made of bamboo and wall made of mud; typical of southeastern Bengal. (Photo A.K. Dutt)

Fisherman's hut, about 40 miles south of Madras; walls and roofs made out of coconut leaves. (Photo A.K. Dutt)



Western influenced designs penetrated in India with colonial occupation. Though this is a photo of Jain temple in Calcutta, such western influenced palatial house designs were usually built by former feudal landlords as their residence, both in rural and urban areas. Many colonial-time government buildings also followed the same architectural pattern. (Photo Sunil Sarkar)

Rich peoples urban house-type, probably originating in Bengal resulting from British contacts; this type diffused to other eastern states of India primarily with the out-migration of educated Bengali. This is a house in Patna. (Photo A.K. Dutt)

## LITERACY

Education plays a very important role in nation-building. Literacy means only the ability to read and write simple phrases, and is applied to persons over the age of five years. The strength of the foundation of Indian education must be judged by standards of literacy. When the country became independent in 1947, six of every seven Indians were illiterate. As a result of intensive efforts on the part of the national government, by 1971 the literacy rate had climbed to 29.4%. However, a serious imbalance in the education of sexes still exists.

Literacy is of prime importance for the diffusion of modern ideas and technologies. A study of textile workers in Bombay discovered a substantial correlation of job performance and comprehension in groups of literate and illiterate workers, with the literate workers understanding the production process better and having a higher sense of responsibility than their illiterate co-workers. In a different kind of study, literate farm workers were found to use increased amounts of fertilizers which is a precondition for the success of the Green Revolution technique. In this way, literacy and an increased pace of agro-industrial productivity can be correlated.

The existence of the 70% of the national population which remained illiterate was thought by the Indian Planning Commission to be detrimental to national growth. Therefore, the Fifth Five-Year Plan envisioned a very significant rise in the rate of literacy in order to promote development. Mass literacy has been given top priority, and over 50% of the education budget will be invested towards this end.

By the end of the Fifth Five-Year Plan in 1978-79 it is anticipated that almost all the children between the ages of six and eleven will be enrolled in classes. Approximately four-fifths of the children in the above age group are attending primary and junior schools in 1974-75. Programs for adult illiterates are being established through night classes, factory schools, and media instruction, all of which are under national government sponsorship and supervision.

In general, south India has a higher literacy rate than the north. This probably may be attributed to greater frequency of contact of India's maritime south with the Western nations. In addition, the western coastal plains of India have a high rate of literacy, probably due also to frequent intercourse with European countries. Also, areas of Christian dominance exhibit high rates of literacy as a result of the influence of the missionaries. Mizoram and the coast of Kerala are examples of this phenomenon. Moreover, in Meghalaya, Nagaland, and south Bihar, Christian influence among the aboriginal and hilly tribes has resulted in an increased rate of literacy.

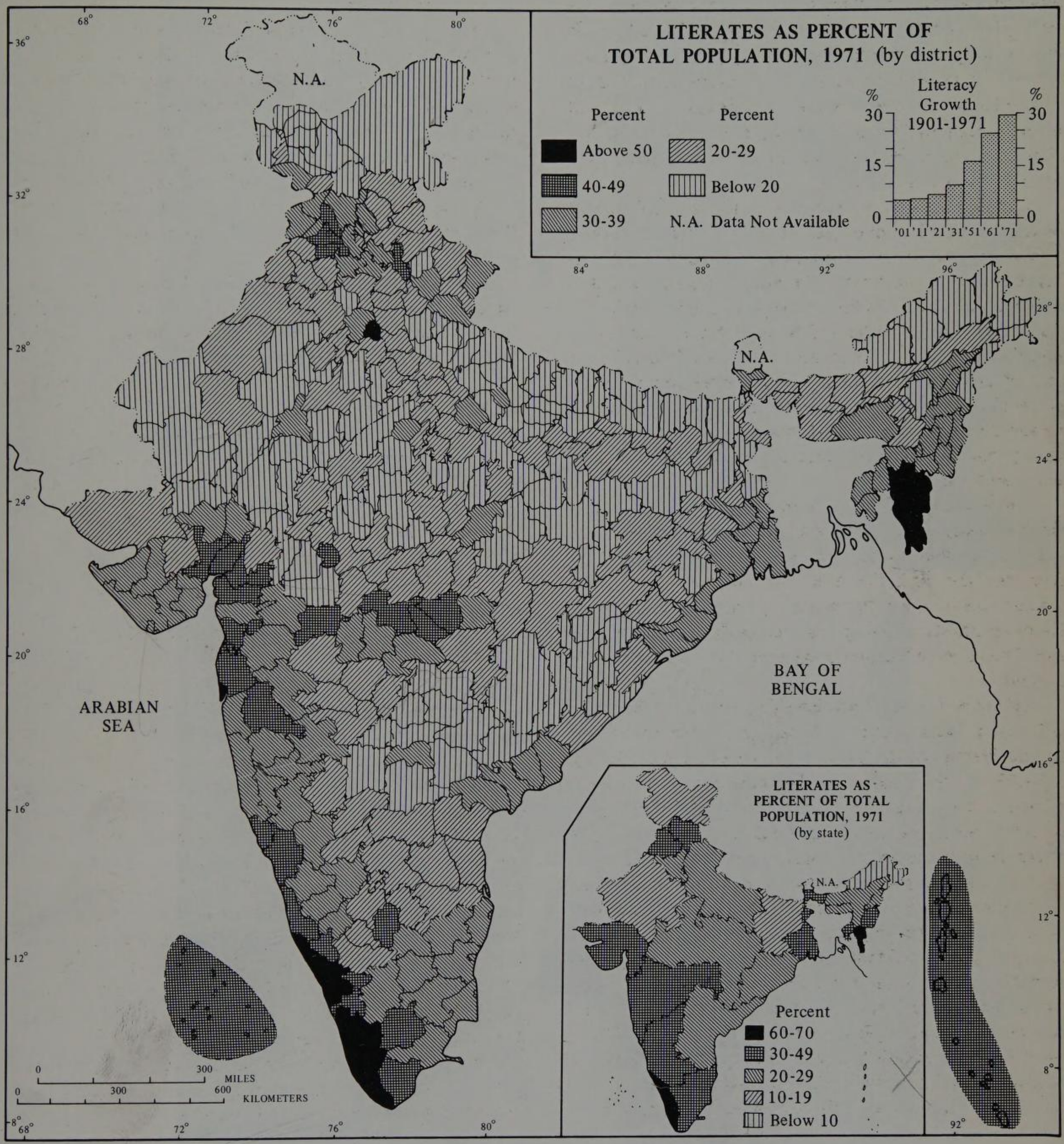
Finally, the large metropolitan cities such as Bombay and Delhi have a large concentration of literates. According to the 1961 Census, urban literacy reached 54% (in the age group 5-14 years) while rural literacy touched only 24% in the same ages. Similarly, in this age group only 6% of the rural children had primary or junior high school education as contrasted with 19% of the urban children. Overall, the rural-urban literacy differential is clear with only 24% of the rural population literate in 1971, as against 53% for the urban population.

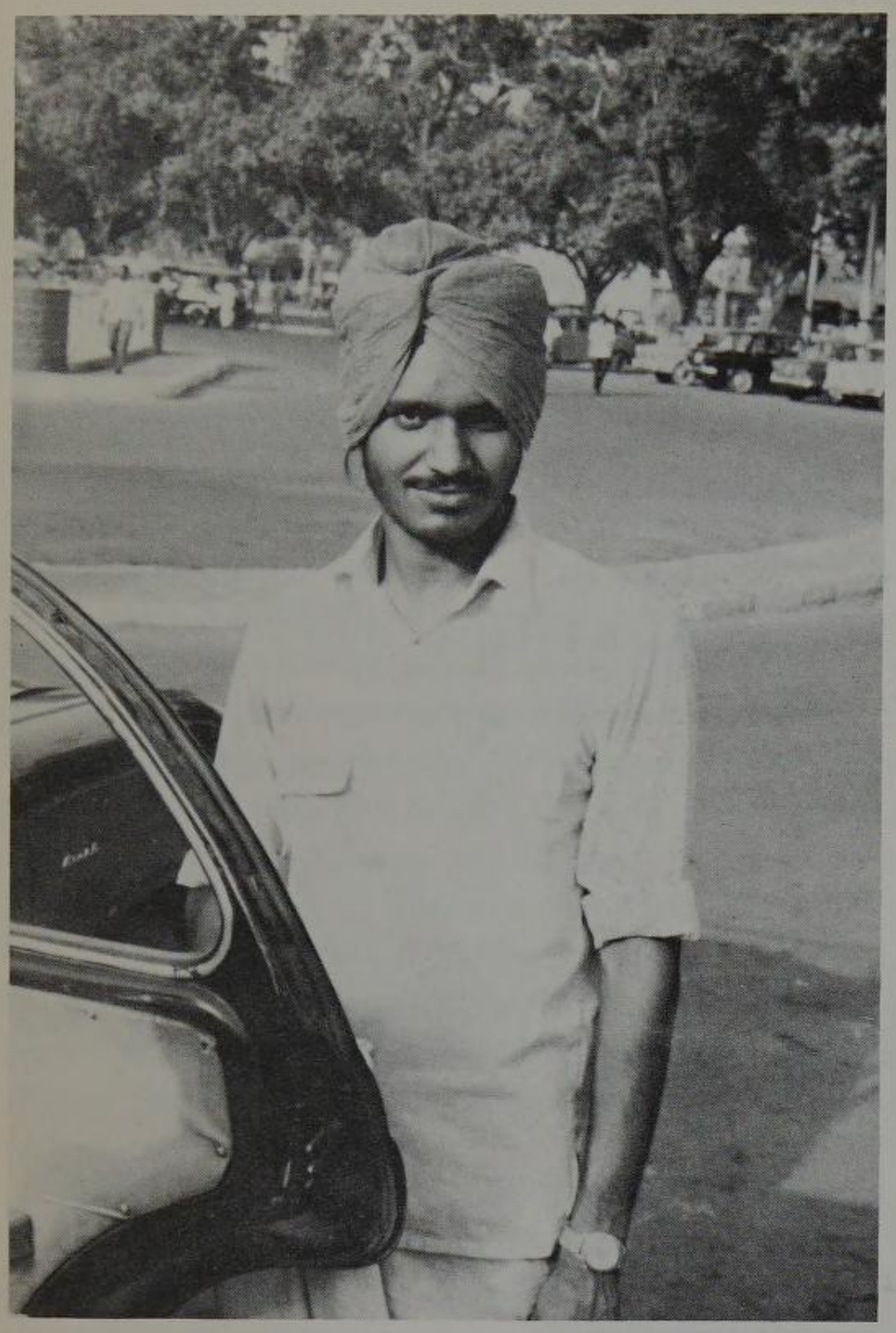
According to the 1971 Census, Kerala is by far the most literate state in India, with 60% of its inhabitants able to read and write, whereas nationally the figure is 50% lower. Moreover, in the same state there exist more equitable rural-urban rates of literacy (59% rural and 66% urban), and male-female rates of literacy (67% male to 54% female). In India, 40% males and 18% females are literates.

Another area where there is a significant difference in literacy rates is scheduled castes and tribes, traditionally forming the lowest social strata. In 1961 only 10% of the scheduled tribes were literate as compared to the national average in that same year of 24%. The ratio of female literacy was alarmingly low, standing at about 3% for both groups.

Although no data have been available since 1931 on literacy by religion, the 1931 patterns probably have not altered greatly. Parsees, Jains, and Christians had high literacy rates for ages 10 and above of 83%, 38%, and 31% respectively. Parsees and Christians are not only the most Westernized, but have greater opportunities for Western education as well; Parsees are mostly an urban dwelling community and Christians are oriented to missionary schools. Jains, in general, are members of rich trading communities and urban dwellers. Therefore, they have more access to higher education. The Sikhs, Hindus, and Moslems each showed less than 10% literacy in the same age group. Moslems had a literacy rate of only 7.2%, and were the least literate of the religious groups. This factor can probably be attributed to their historical antipathy towards Western temporal education. In general, among Hindus, the higher the caste, the greater the degree of literacy.

A significant imbalance in the rate of literacy in India exists not only among regions, religions, and castes, but also between sexes and rural/urban populations.


LITERATES AS PERCENT OF TOTAL POPULATION, 1971 (by district)
Percent
Above 50
40-49
30-39
Percent
20-29
Below 20
N.A. Data Not Available
Literacy Growth 1901-1971
%
30
15
0
'01 '11 '21 '31 '51 '61 '71
N.A.
N.A.
BAY OF BENGAL
ARABIAN SEA
LITERATES AS PERCENT OF TOTAL POPULATION, 1971 (by state)
Percent
60-70
30-49
20-29
10-19
Below 10
0 300 MILES
0 300 600 KILOMETERS
36° 32° 28° 24° 20° 16° 12° 8°
68° 72° 76° 80° 84° 88° 92° 96°



A Sikh taxi driver from Delhi. (Photo A.K. Dutt)

In the *Ghats* of the Ganges in Varanasi people not only change their clothes after taking a dip in the holy river, but spend their time in many other ways. (Photo Hiranmoyee Dutta)

Two Nepalese girls carrying baskets of wood-logs near Darjeeling with a tourist girl from city in the middle. (Photo Sunil Sarkar)

A small girl from a south Bengal village dressed in a *sari* holding her brother. (Photo Jibanauda Chatterje)

## POPULATION DENSITY AND GROWTH

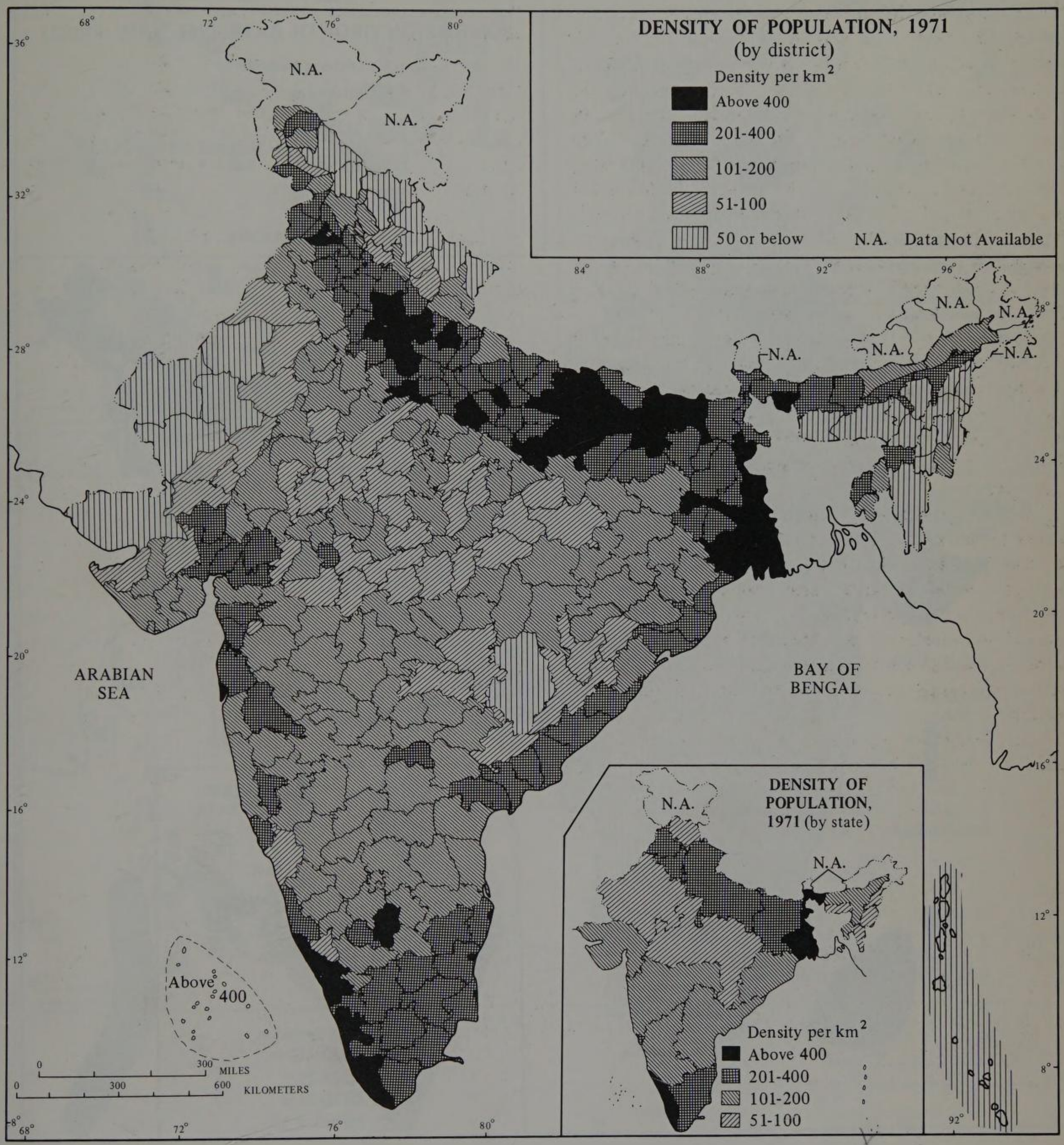
According to the 1971 census, the Indian population stands at approximately 547,000,000 (second only to the People's Republic of China in size) with a population density of 470 persons per square mile. The growth of India's population had been slow in the beginning of the twentieth century. In 1901 India's population density was only 194 persons per square mile. After 1921, however, the growth rate took a significant turn. Between 1921 and 1951 the nation's population grew by approximately 1.2% annually, whereas prior to 1911 the growth rate was much lower and sometimes population even declined. Efficient administrative management, eradication of famines, spread of irrigation, health care, and sanitation are responsible for the large-scale net growth of population registered after 1921. However, the most spectacular growth rate of population has occurred since 1951. The annual growth rate between 1951 and 1961 was recorded at 2.2% increasing to 2.5% annually between 1961 and 1971. The spectacular growth rate of the Indian population was part of the post-World War II "population explosion," which occurred as the result of sharply declining death rates and only mildly declining birth rates.

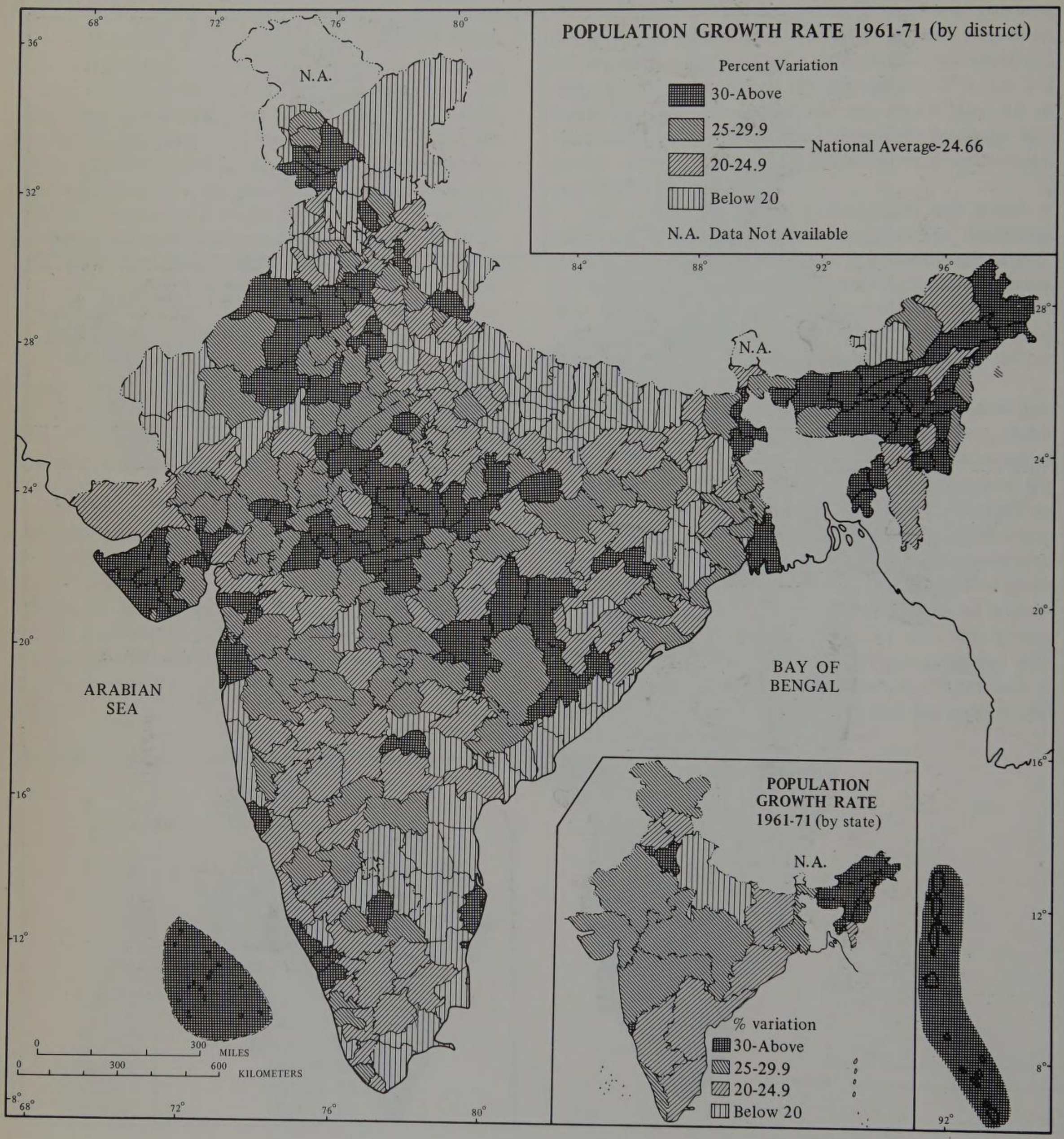
The net growth of population has also been accompanied by increased life expectancy. The current life expectancy in India is slightly over 50 years compared to 27 years prior to World War II. Furthermore, the sheer volume and density of the population generates an ever greater national reproduction rate, which further complicates the problem of national economic growth. In addition, the high agricultural density accentuates the rural unemployment problem.

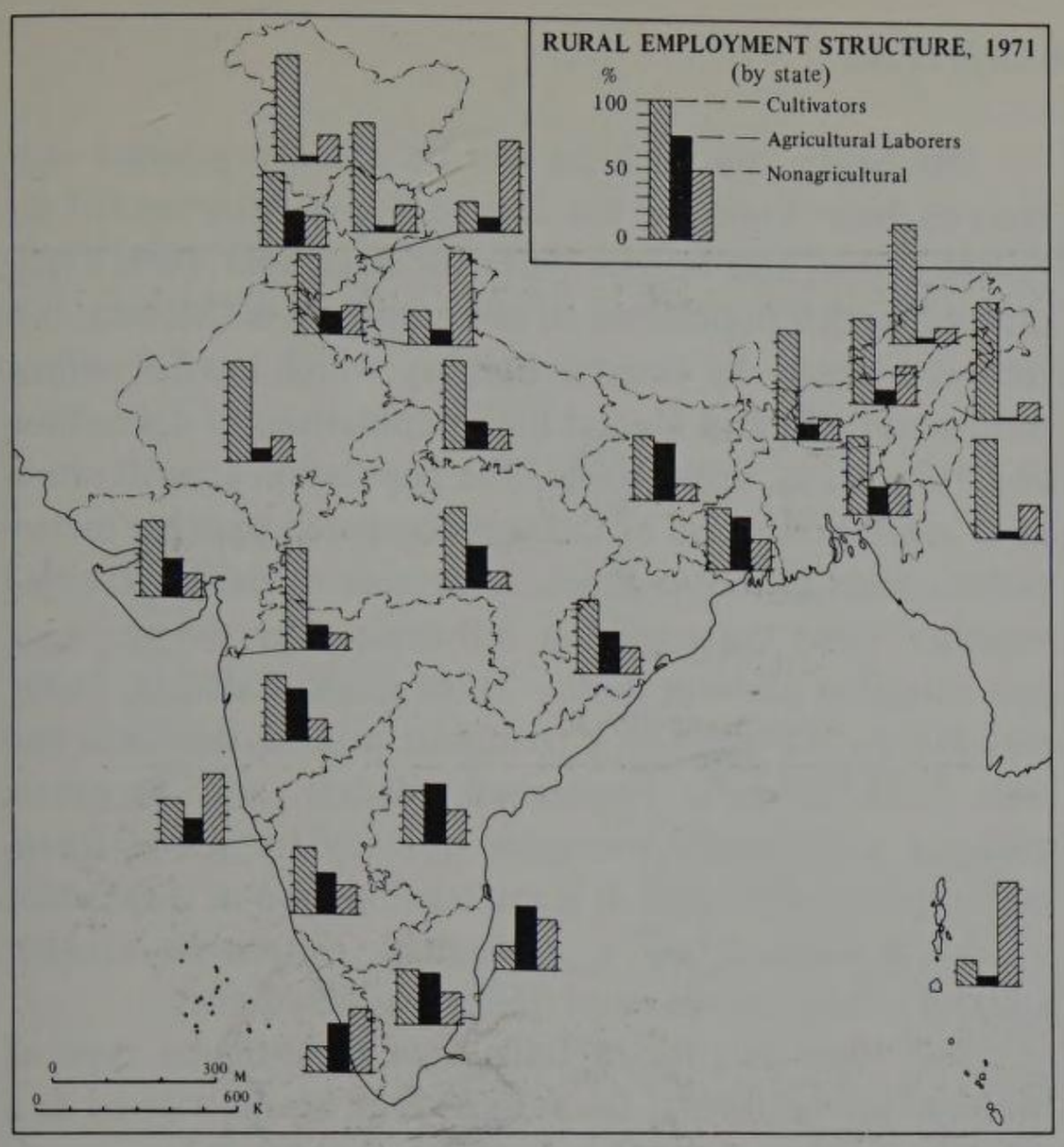
The pattern of population density has remained the same over the last several decades with concentration of population in (1) the Ganges-Brahmaputra plains and the southern coastal plains, (2) the irrigated lands such as the Punjab plains, and (3) the industrial centers of Calcutta, Bombay, and Ahmadabad. The areas of least population density are interior peninsular India (excluding its southern tip), the Rajasthan desert, the swamplands of Kutch and Sunderbans, the Himalayas, and the Assam hills. All of these areas are associated with factors that discourage agriculture: steep slopes, aridity, dense forests, poor drainage, and infertile laterite soils.

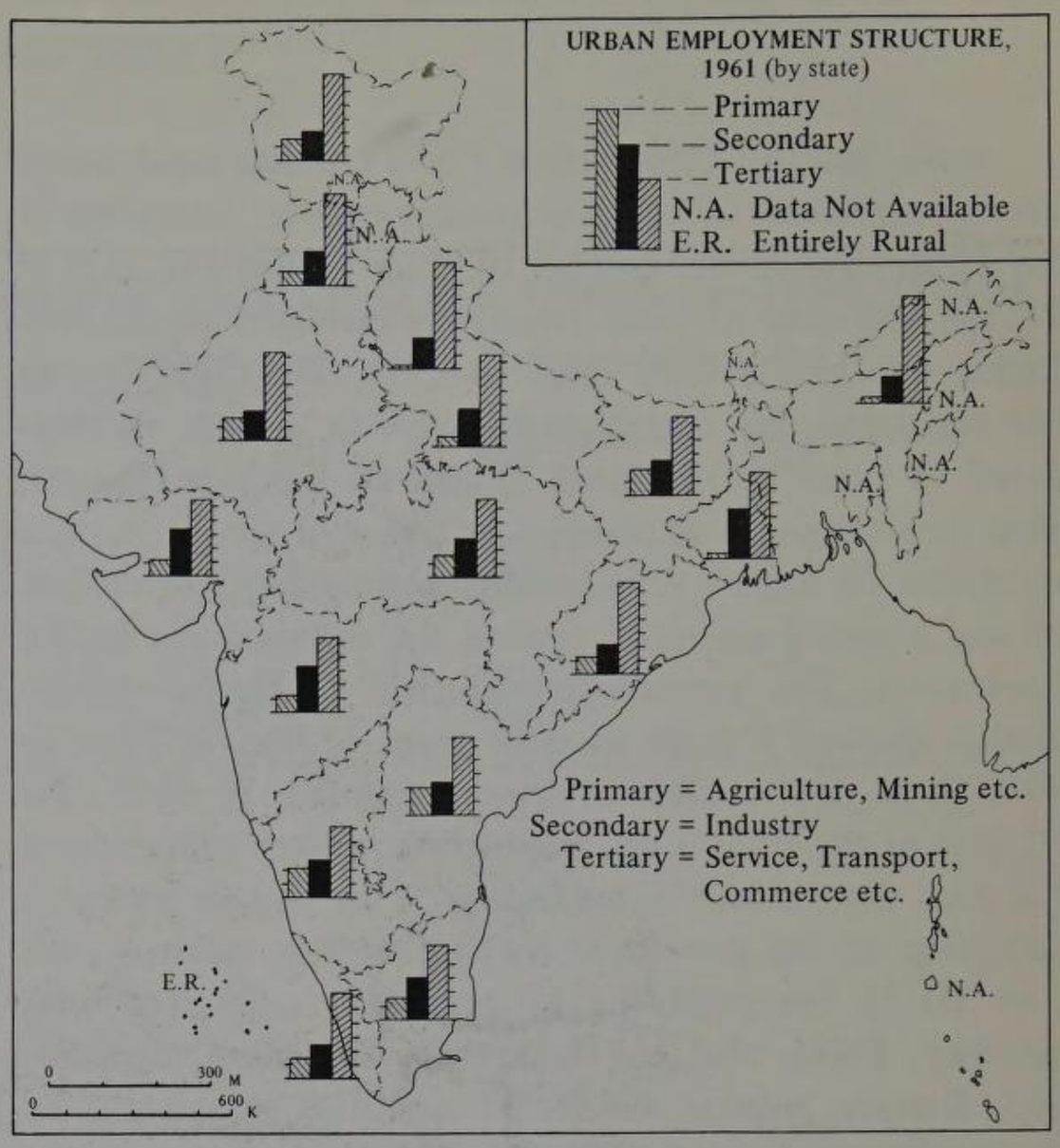
Let us take the case of an area where high density is associated with economic backwardness. The Darbhanga district of the North Bihar Plains is primarily agricultural, but has densities as high as 3 1/2 times the national average, with one of the lowest per capita incomes in the nation. In the plains the density is much higher than the national average and because of the great numbers of people, the per capita income generally registers low.

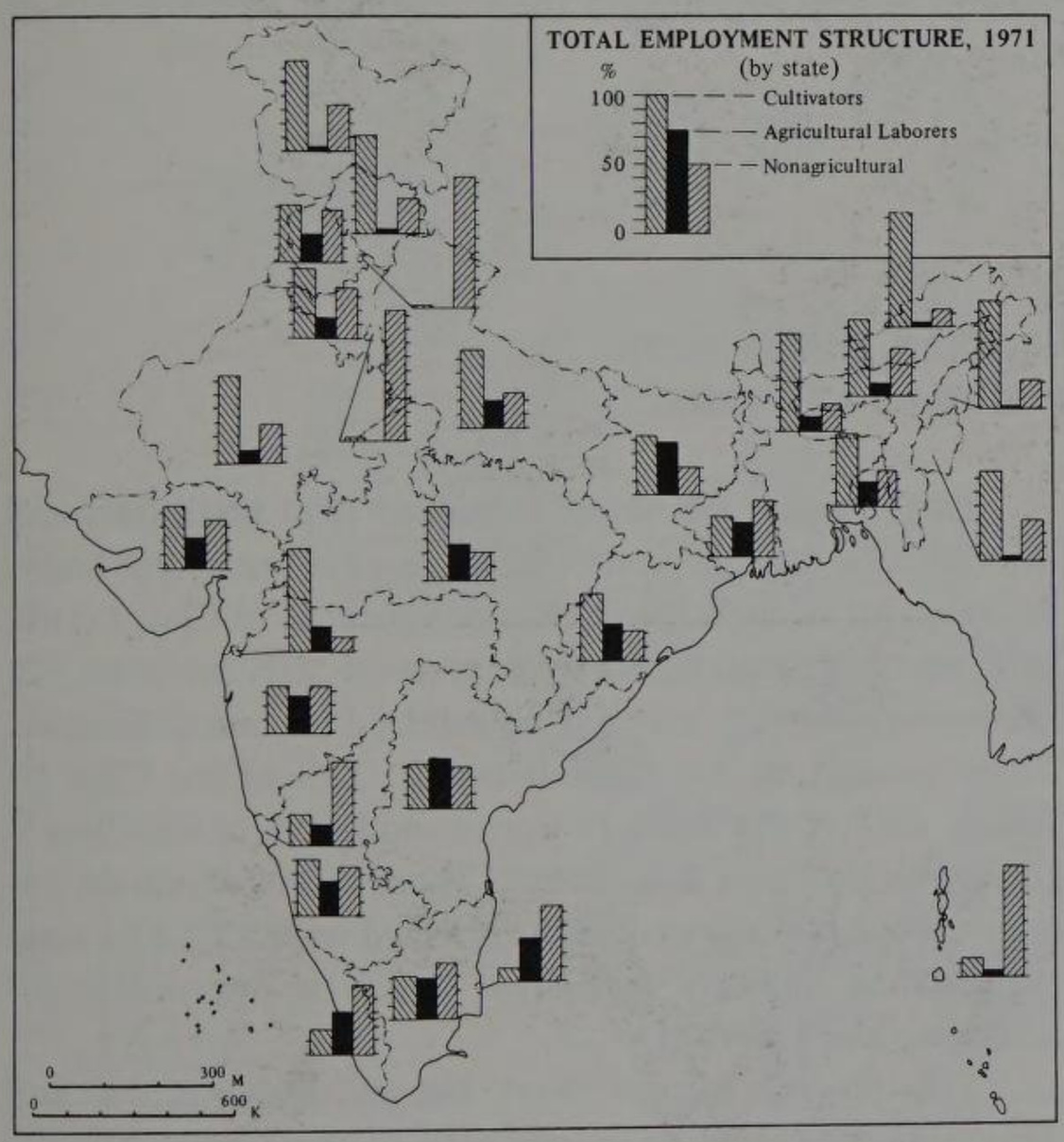
Western European nations with similar population densities do not have such great problems supporting themselves because of their association with manufacturing as opposed to agriculture. Kingsley Davis characterized the Indian population as an oriental agricultural people, long settled in their territory, which they have exploited intensively. As long as such intensive land use remains associated with the traditional subsistence methods of outdated plows and low-yielding seeds, the volume and density of population will remain a burden. However, with the greater expansion of Green Revolution techniques combined with the continued growths of industrialization, the numbers of people may well add to the resources of the country and become an important basis for progress.


DENSITY OF POPULATION, 1971
(by district)
Density per km²
Above 400
201-400
101-200
51-100
50 or below
N.A. Data Not Available
DENSITY OF POPULATION, 1971 (by state)
Density per km²
Above 400
201-400
101-200
51-100
N.A.
ARABIAN SEA
BAY OF BENGAL
Above 400
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°


POPULATION GROWTH RATE 1961-71 (by district)
Percent Variation
30-Above
25-29.9
National Average-24.66
20-24.9
Below 20
N.A. Data Not Available
N.A.
N.A.
ARABIAN SEA
BAY OF BENGAL
POPULATION GROWTH RATE 1961-71 (by state)
N.A.
% variation
30-Above
25-29.9
20-24.9
Below 20
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°




## EMPLOYMENT STRUCTURE CHANGE, 1961-71

Rural Employment Structure

Cultivators

Agricultural Laborers

Non-Agricultural

Urban Employment Structure

Cultivators

Agricultural Laborers

Non-Agricultural

Total Employment Structure

Cultivators

Agricultural Laborers

Non-Agricultural

## LARGE URBAN CENTERS

India has 147 Class I cities (1971), urban areas which have a population of 100,000 or more people. According to the 1961 Census, the number of Class I cities was 113; in 1951 it was only 81. Such cities have increased almost 50% during the decade from 1961 to 1971. The Class I group has registered the maximum population growth, as compared to other smaller-sized groups of cities and towns. Most probably the expansion in this size city is more a reflection of India's development and modernization than of any actual great move toward the urbanization of the population. The percentage of urban to the total population showed a slight increase from 17.98% in 1961 to 19.87% in 1971. Class I cities accounted, in 1971, for 52.41% of the total urban population, a clear indication of the fact that India's urbanization is to a great extent a reflection of the growth of its largest cities. Actually, the first 10 of the most highly populated cities (Calcutta, Bombay, Delhi, Madras, Hyderabad, Bangalore, Ahmadabad, Kanpur, Nagpur, and Pune) constitute almost 50% of the total population of all Class I cities.

The large cities of India are widely scattered except in the northern Himalayan rim, the central dry uplands, and the western deserts. There are, however, four principal nuclei of urban concentration around Calcutta, Bombay-Ahmadabad, Madras-Bangalore, and Delhi.

No single city in India can be called a primate city, such as New York for the United States, Moscow for the Soviet Union, and Buenos Aires for Argentina. India's largest city, with a population of seven million, is Calcutta. It is followed closely by Greater Bombay which has 5.9 million residents. Delhi and Madras have populations of 2.4 million and 1.7 million, respectively. The population growth rate is most rapid in the case of Delhi as compared to other metropolitan areas in recent times. A number of cities combined together exert metropolitan influence over the northern and southern parts of India. Three cities—Calcutta, Delhi, and Bombay—constitute a triangular primacy in north and west India; whereas Hyderabad, Madras, and Bangalore generate a secondary triangular primacy for the southern half of peninsular India. It is the combination of these cities which is engendering a substantial metropolis-oriented cultural and economic development in the country.

The Class I cities of India have a particular type of modern developmental framework that can be viewed as a generator of future growth. India's industrial and economic growth largely depends on the accentuated development of these cities.

## MEDIUM- AND SMALL-SIZE URBAN CENTERS IN COMPARISON TO LARGE URBAN CENTERS

Medium- and small-size urban centers in India are classified by Census authorities as Class II, Class III, Class IV, and Class V towns. In 1971 there are 198 Class II towns, 617 Class III towns, 748 Class IV towns, and 756 Class V towns in India. According to Christaller's pyramidal hierarchy of urban centers, the number of smaller groups of towns multiplies compared to larger cities. In the case of India, such multiplication of small towns does not occur. This is indicative of the fact that the smaller towns are losing population because they are not only uneconomic, but also socially unattractive. As a result, when existing smaller towns are transferred to a high hierarchal rank due to natural population growth, they are not being replaced.

The national capital and all state capitals are Class I cities excepting for two states: Nagaland (Kohima) and Sikkim (Gangtok). Backwardness, lack of economic activity and generally low population densities in the hinterlands have prevented the formation of Class I cities in these two states. Towns in Classes II through V are generally either district or subdivisional administrative headquarters, trading centers, transport nuclei, educational centers, religious places, industrial centers, or a combination of the above.

Larger towns are better organized than small ones and provide city services under the aegis of a municipal body. As a matter of fact, fewer than one percent of Class I cities lack municipal status, whereas as town size decreases, an increasing number are not recognized as municipalities. Three percent of the Class II towns, 15% of the Class III towns, 36% of the Class IV towns, and 42% of the Class V towns, do not have civic status. Those towns which do not have civic status are generally provided with a type of rural organization called a *panchayat* which is responsible for arranging town services.

The three states of West Bengal, Maharashtra, and Jammu and Kashmir have over 60% of their urban populations in Class I cities, although the national average is 52%. The first two states are highly industrialized and overwhelmingly influenced by their primate cities, Calcutta and Bombay, respectively. Jammu and Kashmir have two Class I cities, Srinagar and Jammu, both of which are not only attractive hill stations but also highly-frequented tourist centers. As a result these two cities have achieved regional primacy, although the state as a whole has a sparse population.

# GROWTH RATE OF LARGE URBAN CENTERS, 1961-71

In Millions of Persons

7
4
2
1
Over 100,000

Percentage Variation 1961-71

Over 100.00
25.00-49.99
75.00-100.00
0.00-24.99
50.00-74.99
Decline

1. Ambala Cantonment
2. Saharanpur
3. Muzaffarnagar
4. Meerut
5. Ghaziabad
6. Rohtak
7. New Delhi
8. Aligarh
9. Mathura
10. Farrukhabad-cum-Fatehgarh

Srinagar
Jammu
Amritsar
Jullundur
Chandigarh
Ludhiana
Dehra Dun
Patiala
Moradabad
Rampur
Bareilly
Delhi
Bikaner
Shahjahanpur
Alwar
Lucknow
Gorakhpur
Jaipur
Agra
Muzaffarpur
Darbhanga
Jodhpur
Firozabad
Monghyr
Ajmer
Gwalior
Kanpur
Faizabad-cum- Ayodhya
Bhagalpur
Patna
Jhansi
Allahabad
Varanasi
Bihar
Kota
Mirzapur-cum-Vindhyachal
Dhanbad
Asansol
Udaipur
Gaya
Sagar
Bokaro
Durgapur
Jabalpur
Ujjain
Ranchi
Burdwan
Ratlam
Ahmadabad
Jamshedpur
Calcutta
Nadiad
Bhopal
Jamnagar
Indore
Kharagpur
Baroda
Bilaspur
Rourkela
Dhulia
Jalgaon
Burhanpur
Surat
Raipur
Rajkot
Nagpur
Bhavnagar
Durg-Bhilainagar
Cuttack
Nasik
Malegaon
Amravati
Bhubaneswar
Akola
Ulhasnagar
Aurangabad
Berhampur
Nanded
Thana
Nizamabad
Visakhapatnam
Ahmadnagar
Greater Bombay
Pune
Sholapur
Gulbarga
Warangal
Rajahmundry
Sangli
Hyderabad
Eluru
Kakinada
Vijayawada
Kolhapur
Bijapur
Kurnool
Guntur
Machilipatnam (Bandar)
Belgaum
Tenali
Hubli-Dharwar
Bellary
Nellore
Davanagere
Bhadravati
Shimoga
Bangalore
Madras
Mangalore
Cuddalore
Mysore
Calicut
Kumbakonam
Thanjavur
Cochin
Madurai
Alleppey
Tuticorin
Quilon
Tirunelvelli
Trivandrum
Nagercoil

1. Kancheepuram
2. Vellore
3. Salem
4. Erode
5. Tiruppur
6. Singanallur
7. Coimbatore
8. Dindigul
9. Tiruchirapalli

Gauhati
Imphal

0 300 M
0 300 600 K

## CALCUTTA AREA

Hooghly-Chinsura
Bhatpara
Serampore
Panihati
Kamarhati
Baranagar
Howrah
South Dum Dum
Garden Reach
Calcutta
R. Hooghly
South Suburban

68° 72° 76° 80° 84° 88° 92° 96°
36° 32° 28° 24° 20° 16° 12° 8°

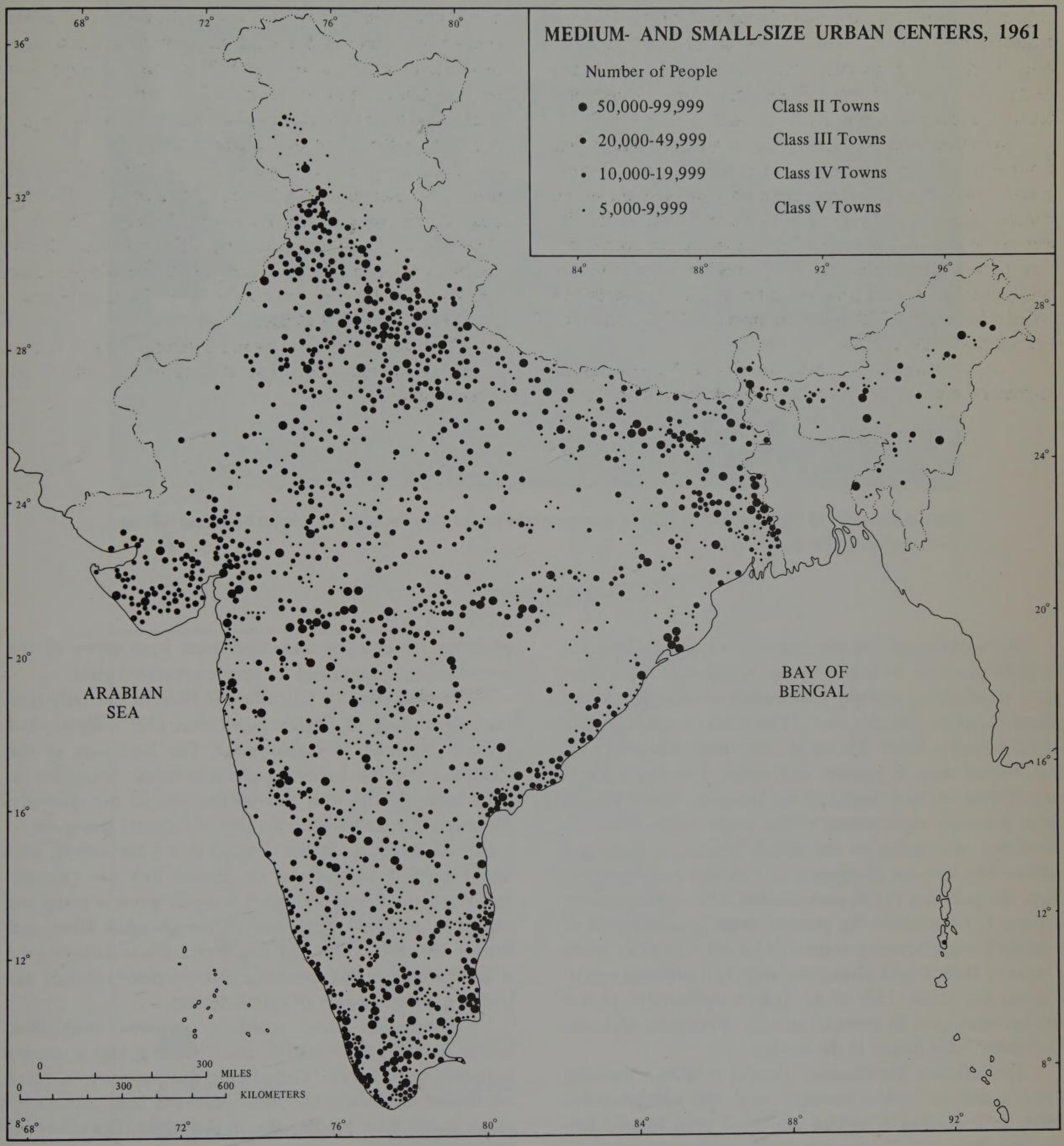
In Assam, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, and Orissa, all backward and primarily agricultural states, the proportion of urban population in Class V towns is over 10%, while the national proportion is only 5.2%. In general, the more industrialized states have a greater proportion of their population in larger cities as contrasted with a greater proportion of the population being concentrated in the smaller towns in the predominantly agricultural and/or backward states.

The larger cities, which attract a greater immigration from both smaller urban centers and rural areas, have a greater concentration of the working-age population, with a consequently lesser proportion of people both under the age of 14 and over the age of 60. In the larger urban centers, particularly in Class I cities, single male migration is substantial. As a result, the sex ratio in Class I cities is 824 females for every 1,000 males, compared to 900 females for every 1,000 males in Class V towns.

The working force participation rate for females increases as the size of the urban area decreases: in Class I cities it is 8%, in Class II, 11%, in Class III, 13%, in Class IV, 16%, and in Class V, it is 17%. The increasing female working force participation rate in smaller cities is attributable to the changing structure of occupation. In Class I and II cities, less than 1% of the working force is engaged in agriculture, while in the remaining town classifications it increases becoming as high as 18% in Class V towns. Similarly, in Class I and Class II cities, 50% of the working force is engaged in manufacturing, in contrast to an average of only 31% in the other town classifications.

The average size of Class I cities in 1971 was 401,524 people, an increase of 22% over 1961. In the other town class population size remained virtually static. The Class I cities show an increasing density of population. Density decreases as town size decreases: 13,967 people per square mile for Class I cities compared to 1,795 for Class V towns, according to the 1961 Census.

The size of the town in India determines not only its functional characteristics but also its status, density, and social diversity.


MEDIUM- AND SMALL-SIZE URBAN CENTERS, 1961
Number of People
• 50,000-99,999 Class II Towns
• 20,000-49,999 Class III Towns
• 10,000-19,999 Class IV Towns
• 5,000-9,999 Class V Towns
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

Victoria Memorial of Calcutta built in 1906 in memory of the Queen Victoria; white marble has been used throughout the building. (Photo A.K. Dutt)

## CALCUTTA

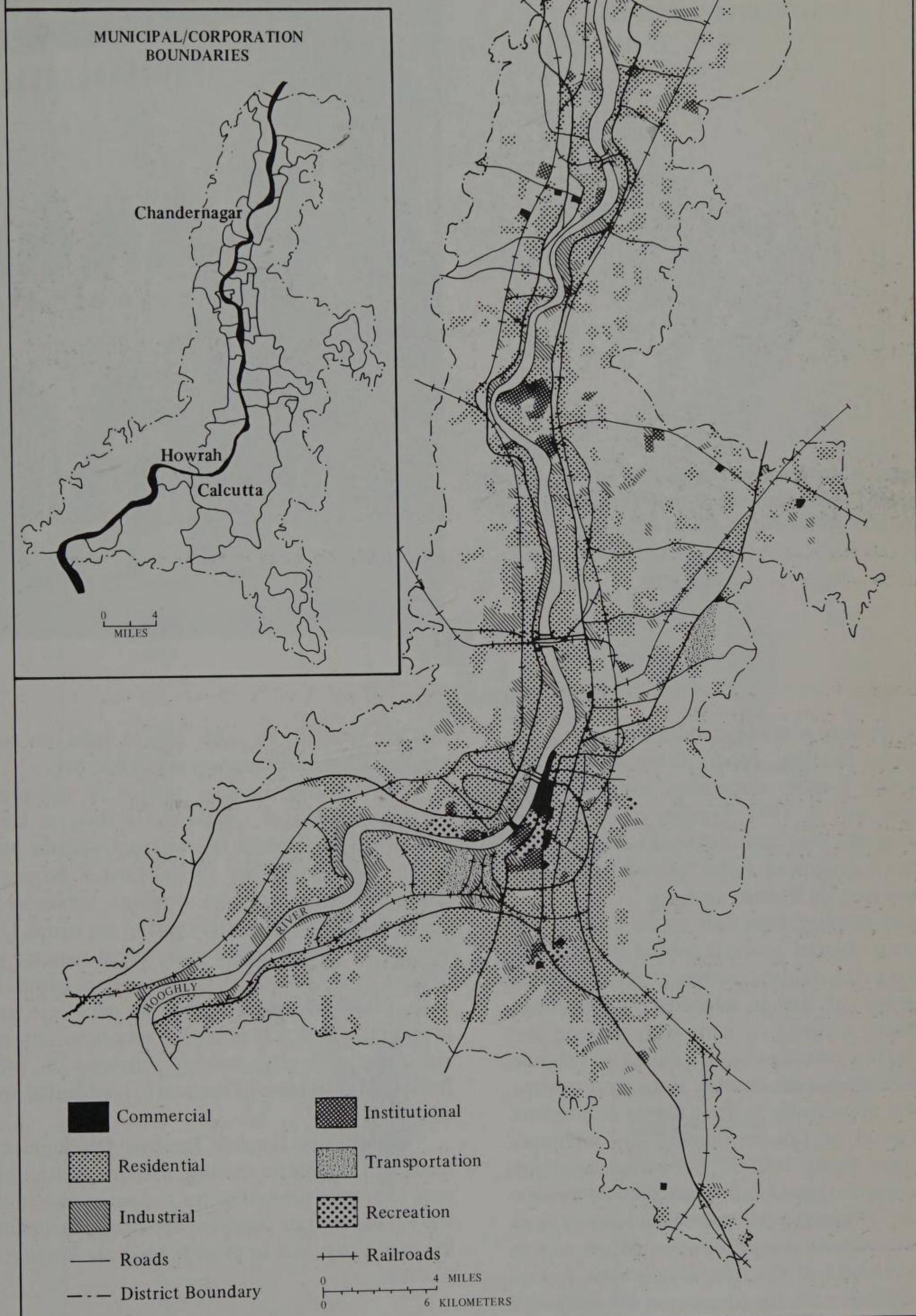
The founding of Calcutta is attributed to Job Charnock in 1690 when he, on behalf of the British East India Company, established a military cum trading encampment at the village Sutanuti (present site of Calcutta) on the left bank of the Hooghly River. Thereafter, the small fisherman's village turned into a gigantic metropolis; forming a linear conurbation on both banks of the Hooghly, one of the ten most populous metropolises of the world. Until 1911 Calcutta was the capital of the British Empire of India and Burma. The national importance of Calcutta may be judged from the fact that (1) its port handles 42% of the nation's exports (2) it contains the greatest single concentration of country's manufacturing activity, 15% (3) it handles about a third of India's bank clearances, and (4) it provides opportunities for about 13% of all India's students to pursue college education. In terms of number of students, Calcutta University is the largest in the world.

The Calcutta Metropolitan District (CMD), a planning unit formed in 1961, contains over 500 administrative units, with compactly settled urbanized areas formed into Municipalities and Corporations. The two corporations are the City of Calcutta and Chandernagar, a French enclave before 1947. CMD provides a sound basis for city-regional planning for existing urbanized areas irrespective of the municipal boundaries and for future urbanized areas.

The twin cities of Calcutta and Howrah not only contain about half of CMD's population (7.0 million), but provide the bulk of employment. The land uses of the District show the following characteristics: industries on both banks of the river and by the side of the railroads; commerce concentrated in the city of Calcutta giving rise to a Central Business District situated in the east-central part and nucleated around the old British fort site (Writers' Building); residences following a linear pattern along the highlands provided by levees of the Hooghly River and former channels of the Ganges. Such a linear development is attributable to the existence of swamplands around the levees, a typical feature of deltaic terrain.

Calcutta has many problems: extreme congestion, health hazards, slow traffic, poor housing, and a meager industrial growth rate. Considering the enormity of these continuing problems, the metropolis has been termed by many as the most problematic in the world. The efforts of the CMD planning organizations to solve those problems are handicapped by economic inabilities.

## CALCUTTA METROPOLITAN DISTRICT EXISTING URBAN LAND USE



British Influence in Architecture. This building on the campus of Bombay University is a combination of Islamic and Gothic building styles with the latter predominating. (Photo A.G. Noble)

## BOMBAY

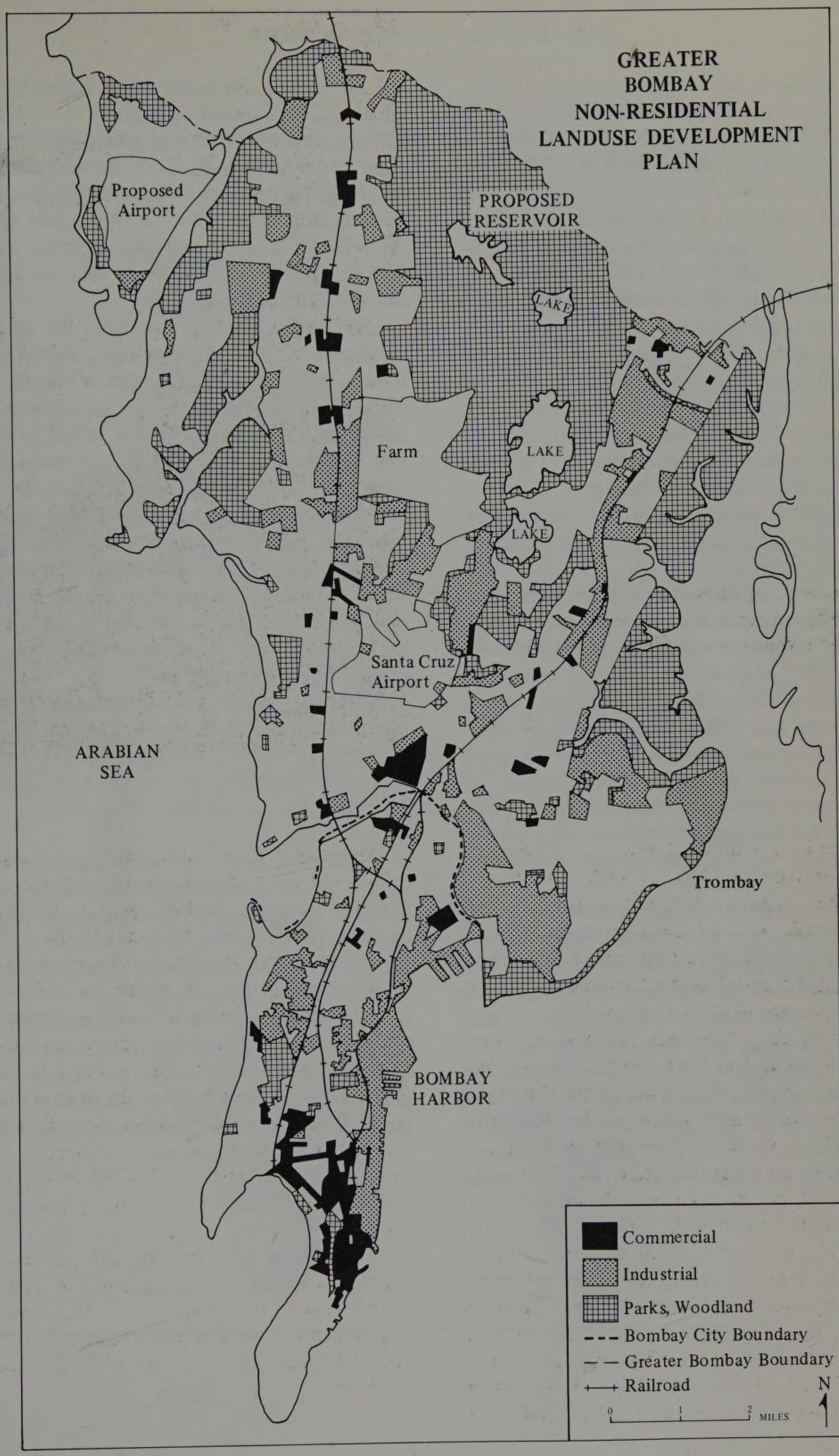
The city of Bombay is an island which forms the southern tip of Greater Bombay. Bandra Creek separates the island from Greater Bombay which came into existence as an administrative unit in 1957. Bombay is not only the capital of one of the most industrialized states of India, Maharashtra, but is designated as the "gateway of India" as it is India's major port for Western contacts.

The origin of Bombay dates back to the year of 1664 when the Western colonial interests needed the establishment of a trading cum military outpost at this site, which was then a group of islands inhabited by fishermen. Bombay eventually attained its fame with growing port activities and cotton textile industries during British rule. Of all the Indian metropolises, Bombay is the most westernized; the imprint quite visible in the building architecture.

The population of Greater Bombay has multiplied almost seven times during 1901-71, but almost two-thirds of the current population (5.9 million) remains concentrated within the 26 square miles of the island-city of Bombay, raising congestion to over 1,400 persons per acre in some of the 144 slums of the city. A large-scale vertical expansion of buildings both for commercial and residential uses has resulted. No other city in India has such a large concentration of skyscrapers as has Bombay.

The existing landuse pattern is characterized by (1) concentration of commercial activity in the southern part of the city, which is associated with the historic fort location and giving rise to the Central Business District, (2) agglomeration of port oriented industries near the docks, located on the eastern part of the island, (3) localization of the cotton textile mills, which required large areas of land, in the central part of the present island city (at the edge of the urbanized area when the mills were established), (4) post-World War II industrial establishments in the eastern sector of Greater Bombay following the proposals of Bombay's 1948 Master Plan, and (5) residential areas spread all over.

The Greater Bombay Landuse Development Plan intends to (1) preserve existing patterns of land uses with a view to protect the best of the present character of Bombay and (2) redistribute densities, deconcentrate industries from the island city, and to provide adequate housing and other facilities.


GREATER
BOMBAY
NON-RESIDENTIAL
LANDUSE DEVELOPMENT
PLAN
Proposed
Airport
PROPOSED
RESERVOIR
LAKE
Farm
LAKE
LAKE
Santa Cruz
Airport
ARABIAN
SEA
Trombay
BOMBAY
HARBOR
Commercial
Industrial
Parks, Woodland
Bombay City Boundary
Greater Bombay Boundary
Railroad
N
0
1
2
MILES

## RURAL/URBAN CHANGE IN INDIA

Rural/urban change in India is evidenced in the increasing proportion of urban population to the total population: between 1941 and 1971 this proportion almost doubled. In 1971, 19.87% of India's population lived in urban areas. The rate of change has shown a remarkable increase particularly between 1941 and 1951, a reflection of the trends of urbanization in the years following World War II and the independence of India. Since 1951 urbanization has increased at a low but steady rate, a result of the consistent migration from rural to urban areas.

Most of the migrants move to urban centers for economic reasons such as employment, but some are attracted by the "lure" of the city, and its amenities: piped water, sewerage, modern schools, movie theaters, and so forth.

The migration causes an influx to the cities of rural males who eventually save enough money to send back to their wives, children, or other relatives on a regular basis. Through such remittances, rural areas become financially dependent on the urban areas.

Additionally, rural unemployment, which arises from an increasing birth rate and a static amount of cultivable land, is compelling villagers to migrate to the cities to seek work. A large number of these rural migrants are unwelcome additions to an already inflated urban unemployment situation. This is especially true in view of the recent adoption of automation in urban industries which has decreased the utilization of unskilled labor. Thus, the dichotomy of increased productivity through automation on the one hand, and the need for increased employment opportunities for the rural migrants on the other is polarizing Indian labor.

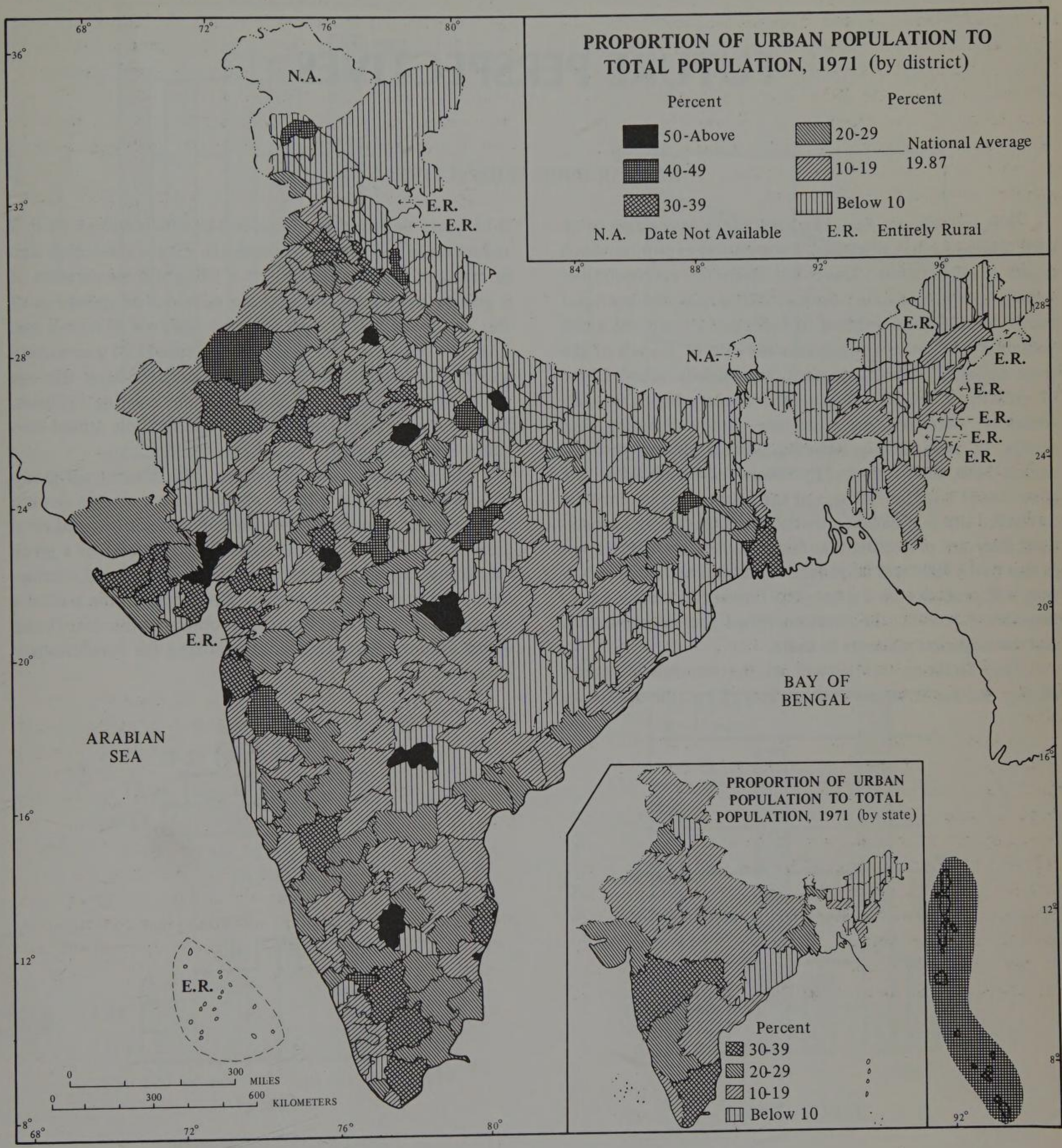
Socially, the rural/urban change is resulting in the withering away of the joint or extended family system which has existed in traditional Indian society for 5,000 years. Let us examine some factors of such withering. First, frequently an urban male must go to another city to seek employment. Thus, a family with four sons may see them scattered to four different areas. Second, traditionally the father used to command the highest respect in the village economy not only because he was the head of the family but also because he was the head of the farm. His authority was unquestioned. In an urban economy, however, while the son lives in the house of his father, his wages may be equal to, and sometimes greater than, his parents. The father's authority is thereby diminished. Third, since there is no Social Security or few retirement plans in India, after retirement the parents in urban areas generally are dependent on their sons for food, clothing, and other necessities. As a result, parental command is losing its effectiveness. This is another manifestation of the clash between modernism and traditionalism.

The urban areas are invariably the centers of government where the administrators, politicians, and other leaders of society usually reside. Generally speaking, the members of the political power groups were educated in a school system initiated by the British. They tend to be more enlightened, modernized, and open-minded than the rural folk. Indian democracy, which is the largest democracy in the world, has given equal voting rights to urban and rural citizens, literates and illiterates alike. The overwhelming proportion of the Indian population lives in rural areas where illiteracy is very high. Thus, the rural/urban dichotomy in synthesizing the attitudes of the recognized leaders on one hand, and the mass of the people on the other, remains most often unresolved.

Spatially, the district containing, or in the vicinity of, metropolitan areas, such as Calcutta, Bombay, Delhi, Ahmadabad, Kanpur, and Hyderabad, has the largest concentration of urban people. Moreover, it is evident from the map that the western half of the country is more urban than the east.

Physically, rural/urban change is reflected in both sectors. In the urban areas, particularly in larger cities such as Calcutta, Bombay, Delhi, and Madras, the increase in height of the buildings has significantly altered the appearance of the skyline. In the rural areas, the introduction of paved roads, rail lines, concrete buildings, and transmission and power lines changed the traditional landscape.

Though the urbanization of India is primarily the result of rural migration to the cities, the backwash of urban ideas and forms into the rural areas also takes place continuously, resulting in changes in the political, physical, economic, and social life-styles in both sectors.


PROPORTION OF URBAN POPULATION TO TOTAL POPULATION, 1971 (by district)
Percent
50-Above
40-49
30-39
Percent
20-29
10-19
Below 10
National Average 19.87
N.A. Date Not Available
E.R. Entirely Rural
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
N.A.
E.R.
ARABIAN SEA
BAY OF BENGAL
0 300 MILES
0 300 600 KILOMETERS
PROPORTION OF URBAN POPULATION TO TOTAL POPULATION, 1971 (by state)
Percent
30-39
20-29
10-19
Below 10

# Chapter 8

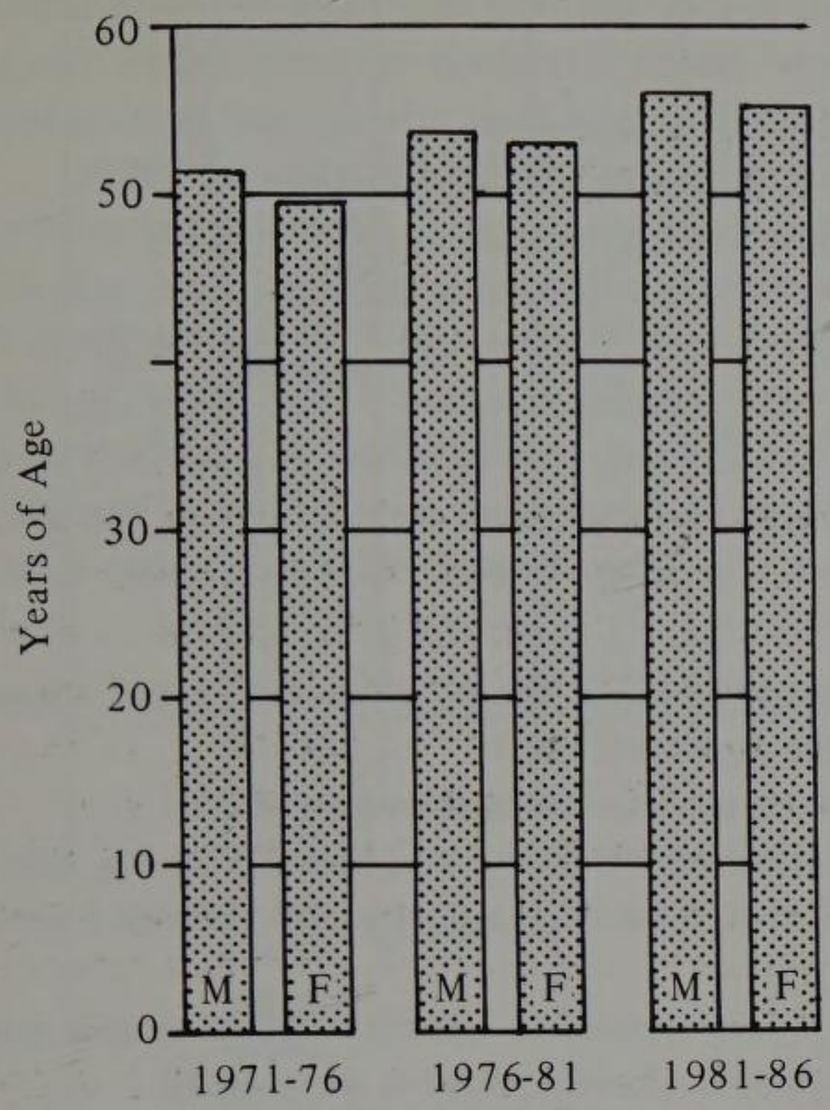
# FUTURE PERSPECTIVES

## DEMOGRAPHIC PERSPECTIVES

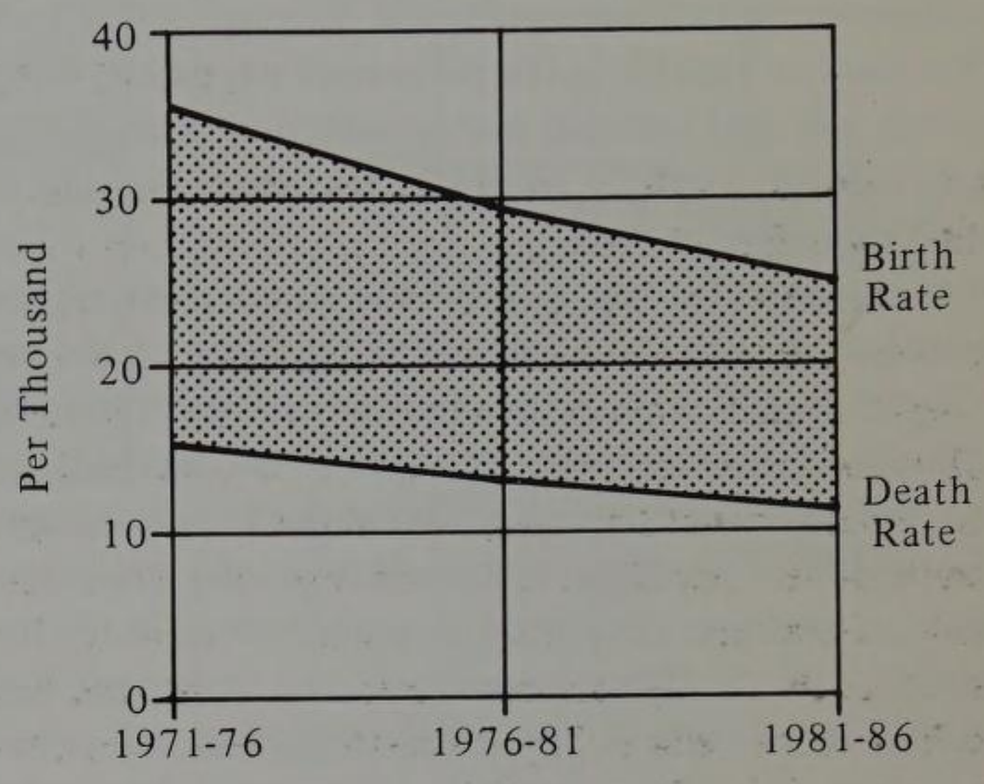
It is well-known that, like most other developing countries, India also has witnessed a population explosion which began in the 1950s. There has been an enormous net growth over the last two decades. This expansion has upset many development projects in India and caused decreased availability of resources because the rate of growth of the gross national product has risen only slightly over the rate of growth of the population. The country has tried very zealously, therefore, to undertake family planning, but results of such family planning efforts during the last decade have been only mildly successful. Nonetheless, the government and the planners of the country are determined to reduce the population growth. Based on such determination, they are projecting that the growth rate of population in the mid-1980s will be reduced considerably. Such reduction will probably be a great step forward in reaching zero population growth, the most cherished goal of population and development planners in India.

The declining net growth of the population should change the age structure considerably. First, the age group 0-14 years will decline considerably which will result in a reduction in the ratio of dependents. This is a welcome sign in terms of raising the standard of living and the creation of a greater proportion of working people. The reduction of this age group will also mean fewer children of school age. This development will facilitate the spread of elementary and middle school education to the individuals of this age group without much expansion of the existing facilities. Thus, the universality of elementary and middle school education will be ensured.

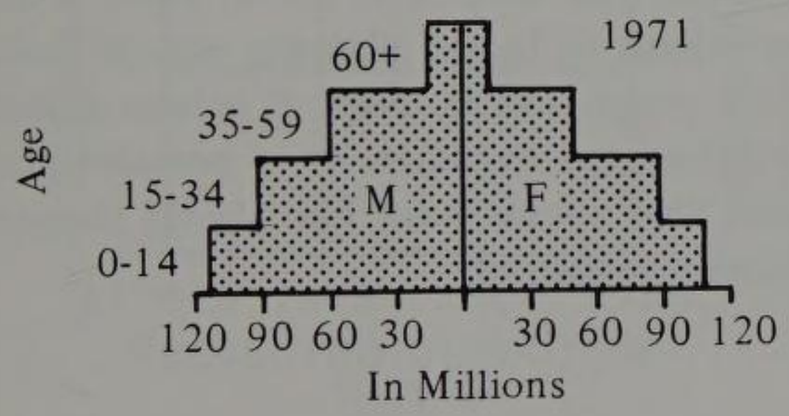
The eventual greater proportion of a laboring age group (15-59 years) in the 1980s will also be a welcome feature provided the employment problem both in urban and rural areas is solved. On the one hand, the prospects of a green revolution, which opens more possibilities for rural employment, is an encouraging feature. On the other, the lack of a solution for the unemployment problem in the near future could produce frustrated youth looking for revolutionary changes.

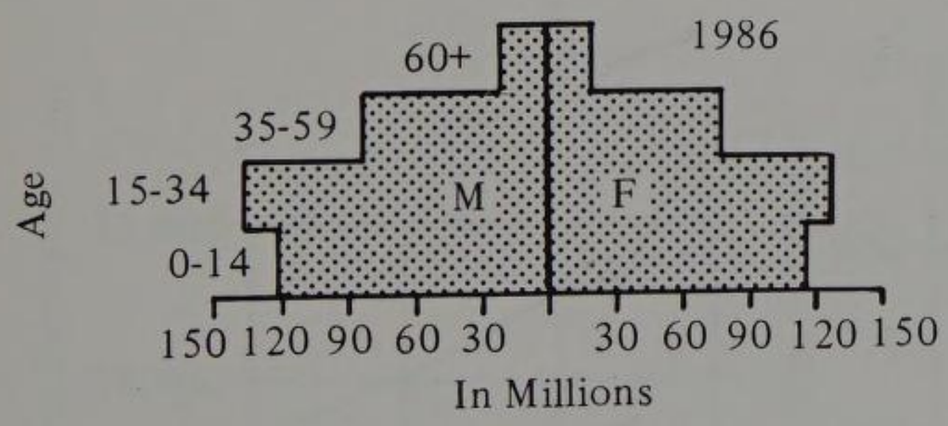



LIFE EXPECTANCY

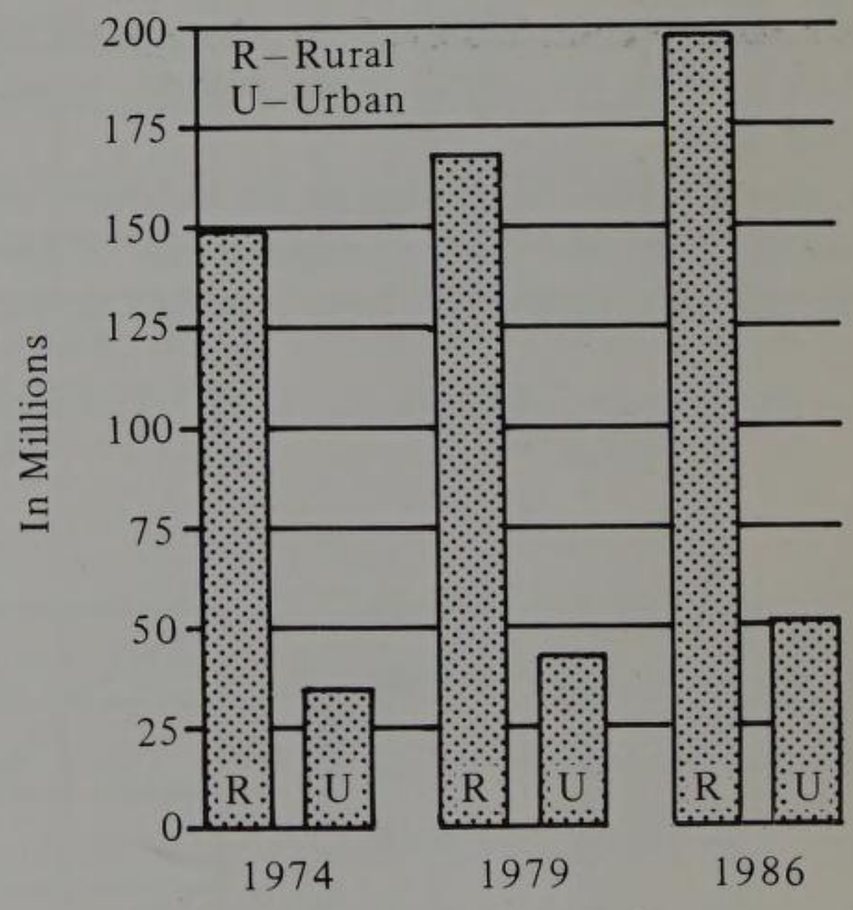



POPULATION GROWTH RATE




AGE-SEX POPULATION




LABOR FORCE

## PROSPECTS OF THE FIVE-YEAR PLANS

Since 1951 India has tried to mold its economy based on national plans. The country has had four five-year plans and three annual plans since then. In 1974 India embarked on the Fifth Five-Year Plan, though only a year later, in 1975, a revision of the Plan was necessary considering sharply rising inflation of 1973-75. This Plan advocates the elimination of poverty and the attainment of economic self-reliance as its two strategic goals. Through self-reliance the Plan aims at equalizing the balance of payments, reducing foreign aid, and creating such production potentialities as might help the country to supply its own necessities for sustained economic growth.

It is projected that by 1985-86 the country will register an economic growth, on a self-sustaining basis, at the rate of 6.2% per annum. It is proposed that exports of iron and steel, aluminum, and engineering goods be encouraged, considering the high raw material potentialities for these manufactures in India. Similarly, fish, leather goods, and cotton textiles also have great potential as export items. In relation to imports, the declining population and increased food production as a result of the green revolution will reduce the necessity for food imports. The need to import machinery and transport equipment, particularly the modern, highly technical types, will not only continue in the future, but demands for them will further increase. The necessity to import fertilizers and fertilizer raw materials will also rise considerably, for the success of the green revolution is dependent on them. On the whole, self-sufficiency requires balancing imports and exports and at the same time taking maximum advantage of those kinds of imports which are either not found in the country or are uneconomic to produce.

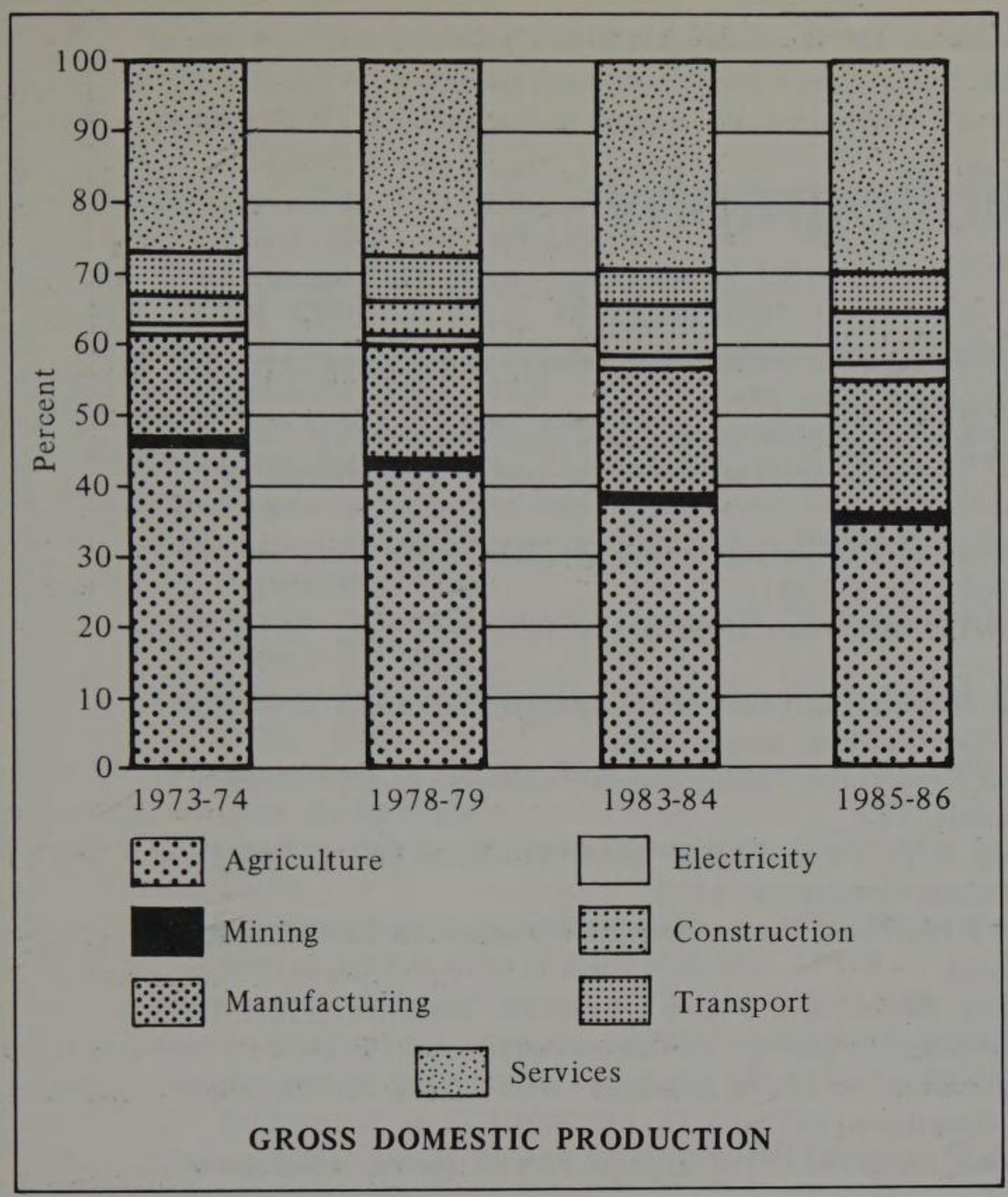
India is a poor country. According to the estimates of the Fifth Five-Year Plan, the private consumption of less than $5 per capita per month has been regarded as the poverty level. Compared to Western standards this figure is almost unbelievably low, but according to Indian standards about 33% of the population is currently below this level. The Plan intends to raise their private consumption beyond the $5 per capita per month level by the mid-1980s.

The main strategy for erasing poverty is the accelerated rate of the country's economic growth: 5.5% annual rate for the Fifth Five-Year Plan and 6.1% for the Sixth Five-Year Plan (to be implemented from 1979 to 1984). Another effort towards the reduction of poverty is through the elimination of inequitable distribution of income and consumption. The plan devised for this purpose is as follows:

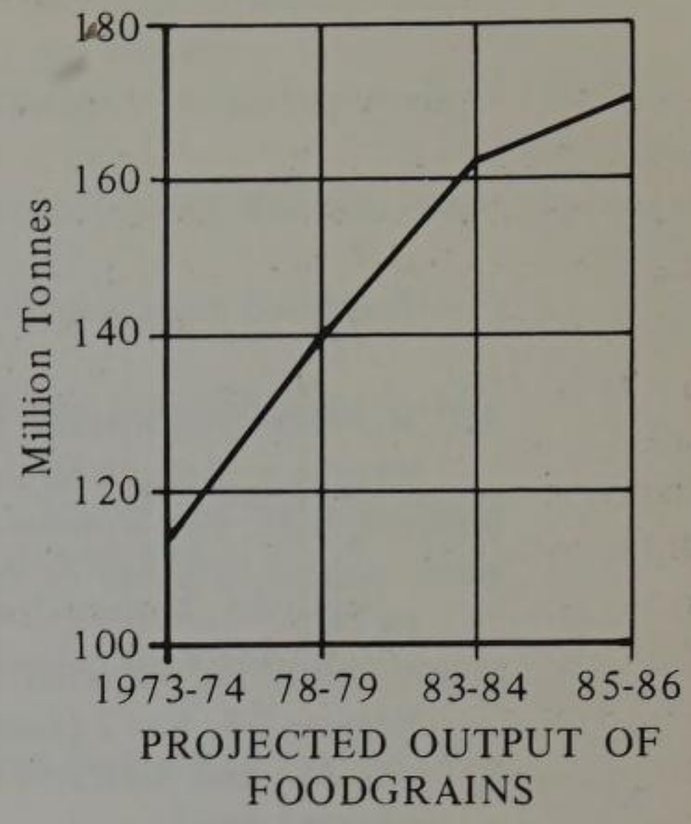
a. massive availability of food and other items of mass consumption;
b. generation of increased employment;
c. institutional reforms and fiscal policies oriented towards reduced inequities and increased productivity;
d. applying stimuli to backward regions and groups of people where poverty is widespread.

Such a perspective will result in a structural change in the sectoral composition of the gross domestic product (GDP).

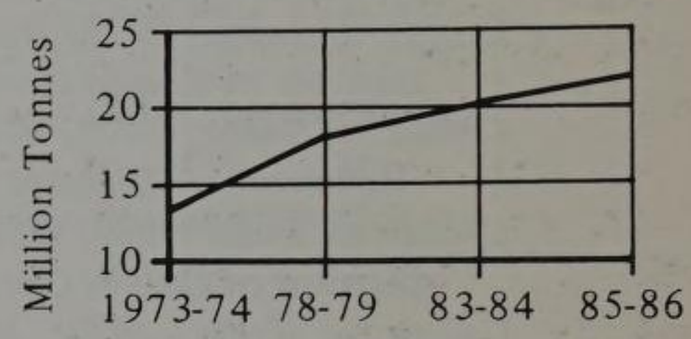
By the mid-1980s the country's GDP will have a reduced proportion of the agricultural component, whereas mining and manufacturing, electricity, construction, transport, and services will have increased their share when compared to the base level of 1973-74. There is no doubt that the very basis of India's planning aims at making the country more progressive in terms of greater industrialization. Nonetheless, the expediencies of previous plans have demonstrated that events have not always happened the way the planners visualized.



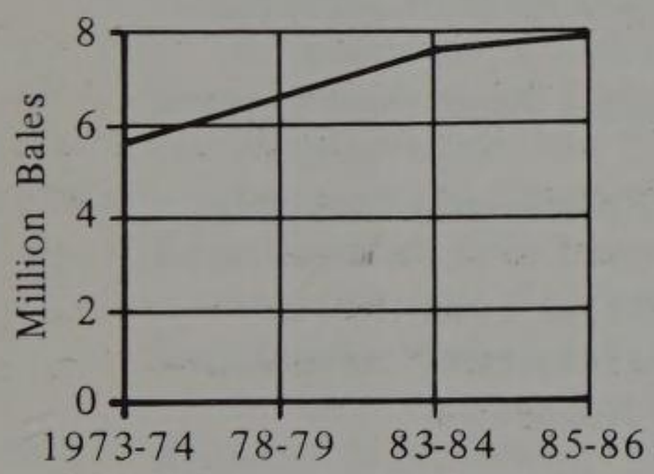

GROSS DOMESTIC PRODUCTION



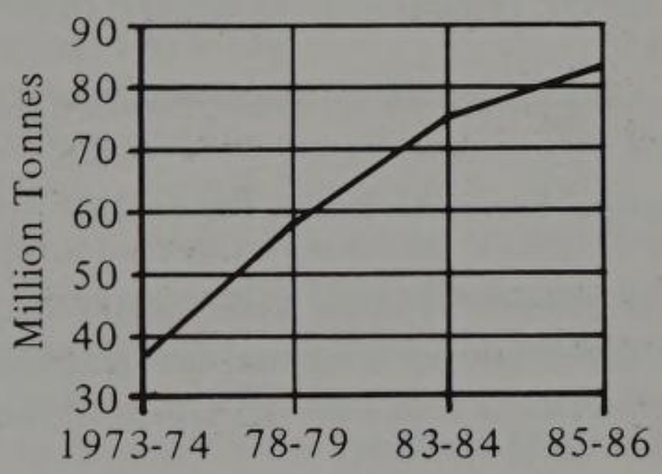

PROJECTED OUTPUT OF FOODGRAINS



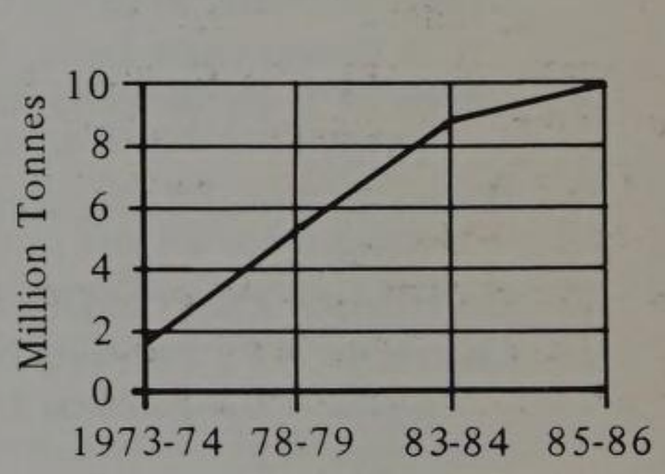

PROJECTED OUTPUT OF SUGARCANE



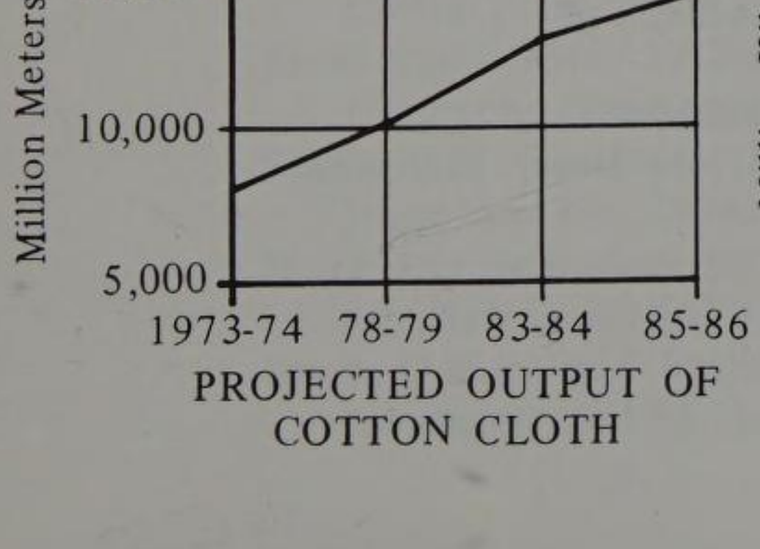

PROJECTED OUTPUT OF JUTE



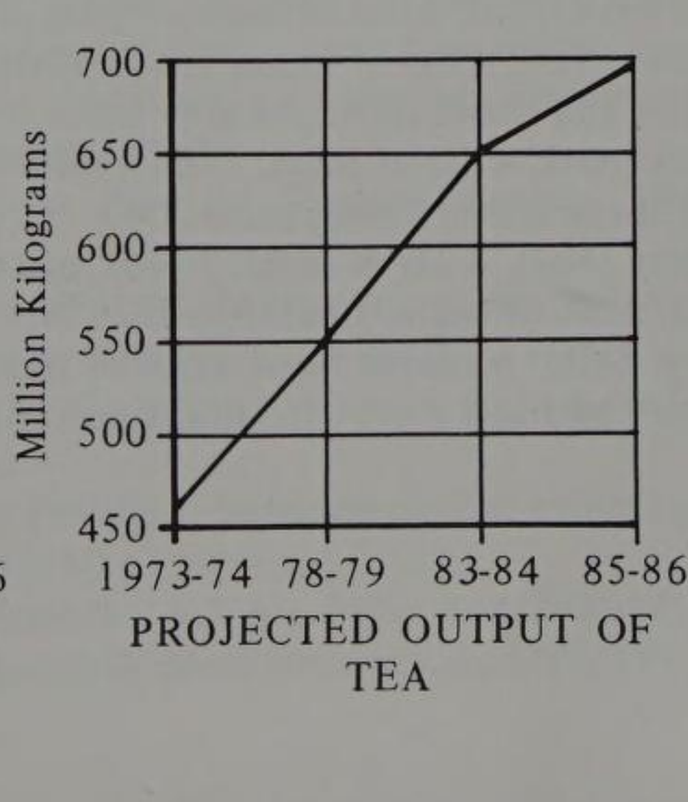

PROJECTED OUTPUT OF IRON ORE



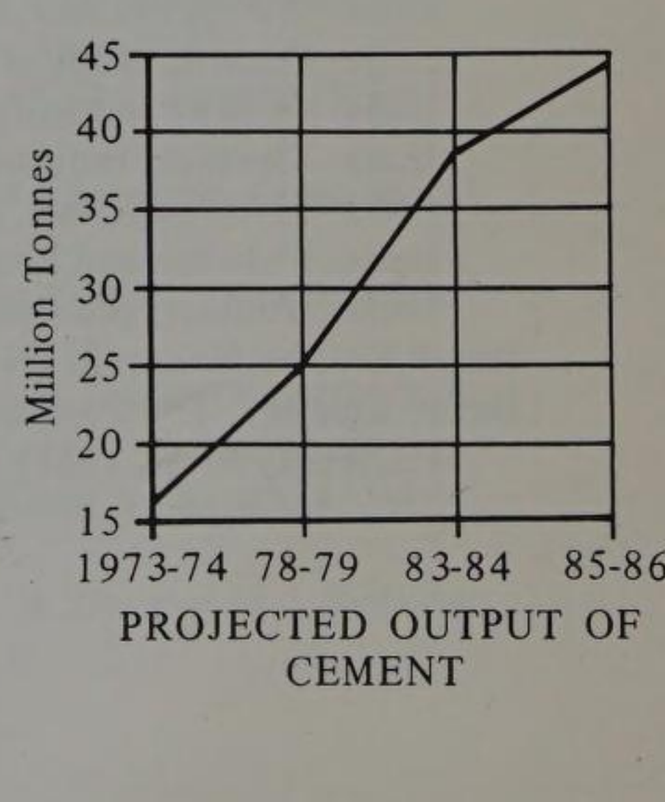

PROJECTED OUTPUT OF FERTILIZERS




PROJECTED OUTPUT OF COTTON CLOTH




PROJECTED OUTPUT OF TEA




PROJECTED OUTPUT OF CEMENT

# Bibliography


Ali, N., *Masautha-Khurd: Land Use and Socio-Economic Survey* (unpublished M.A. dissertation, Magadh University, Bodh Gaya, 1967).

Basham, A.L., *The Wonder That Was India* (New York: Grove Press, Inc., 1959).

Bose, Ashish, *Studies In India's Urbanization 1901-1971* (Bombay: Tata-McGraw Hill, 1973).

Brush, John E., "Spatial Patterns of Population in Indian Cities," *The Geographical Review*, 58, No. 2 (July, 1968), pp. 362-391.

Bussagli, M., and Sivaramamurti, C., *5000 Years of the Art of India* (New York: Harry N. Abrams, Inc.).

Calcutta Metropolitan Planning Organization, *Basic Development Plan Calcutta Metropolitan District 1966-1986* (Govt. of West Bengal, 1966).

*Census of India, 1971, Housing Report and Tables,* Series 9–Kerala, Part IV (Kerala: Director of Census Operations), 1973.

*Census of India, 1971, Housing Report and Tables,* Series 11–Maharashtra, Part IV (Maharashtra: Director of Census Operations), 1972.

*Census of India, 1971, Housing Report and Tables,* Series 17–Punjab, Part IV (Punjab: Director of Census Operations).

*Census of India, 1971, Housing Report and Tables,* Series 19–Tamilnadu, Part IV (Tamilnadu Director and Pondicherry: Director of Census Operations, 1973).

*Census of India, 1971, Housing Report and Tables,* Series 22–West Bengal, Part IV (West Bengal: Director of Census Operations, 1972).

Census of India, Registrar General, *India 1961, Vol. I, India Part IX Census Atlas* (New Delhi, 1970).

Census of India, Registrar General, *India 1971, Language Handbook on Mother Tongues in Census* (New Delhi, 1972).

Census of India, Registrar General, *India 1971, Provisional Population Totals* (New Delhi, 1972).

*Census of India, 1971, Religion,* Series 1–India, Paper 2 of 1972 (Registrar General of India).

Chakravarti, A.K., "India's Agriculture," *Focus,* Vol. XXIII, No. 5 (Jan. 1973).

Chatterjee, S.P., "Aspects of the Study of Regional Geographical Structure," *Acta Geologica et Geographica Universitatis Comenianae, Geographica* No. 6.

Chatterjee, S.P.,

India–Administrative (Natl. Atlas of India, 1966), plate 23
India–Physiographic Regions (Natl. Atlas of India, 1966), plate 41
India–Urban Population (Natl. Atlas of India, 1966), plate 133
India–Waterways and Airways (Natl. Atlas of India, 1966), plate 152
India–Growth of Industries (Natl. Atlas of India, 1966), plate 175
India–Cement and Building Industries (Natl. Atlas of India, 1966), plate 176
India–Chemical Industries (Natl. Atlas of India, 1966), plate 177
India–Livestock (Natl. Atlas of India, 1966), plate 204
India–Fisheries and Poultry (Natl. Atlas of India, 1966), plate 208
India–House Types (Natl. Atlas of India, 1966), plate 227

Das, P.K., *The Monsoons* (New Delhi: National Book Trust of India, 1968).

Davis, Kingsley, *The Population of India and Pakistan* (Princeton, New Jersey: Princeton University Press, 1951).

Dayal, P., "The Location and Development of the Aluminum Industry in India," *The National Geographical Journal of India,* 4, pt. 2 (June, 1958), pp. 67-68.

DeBary, W.T., ed. *Sources of Indian Tradition* (New York: Columbia University Press, 1958).

Dutt, Ashok K., "Daily Shopping in Calcutta," *The Town Planning Review,* Vol. 37, No. 3 (Oct. 1966), pp. 207-216.

——. "Delineation of the Hinterland of Calcutta Port," *The Professional Geographer,* Vol. XXIII, No. 1 (Jan. 1971), pp. 22-27.

——. *India: Resources, Potentialities and Planning* (Dubuque, Iowa: Kendall/Hunt Publishing Company, 1973).

Dutt, Ashok K., and Pyle, G.F., "Dimensions of India's Foreign Trade" in *International Geography 1972,* Vol. 1 (Toronto University Press, 1972), pp. 543-556.

Government of India, *The Gazetteer of India,* Vol. I (Publications Divisions, 1965).

Government of India, Planning Commission, *Draft–Fifth Five Year Plan,* 1974-79, Vol. I (New Delhi, 1973).

Government of India, Planning Commission, *Draft–Fifth Five Year Plan,* 1974-79, Vol. II (New Delhi, 1974).

Government of India, Planning Commission, *Draft–Fourth Five Year Plan,* 1969-74 (New Delhi, 1969).

Government of India, Planning Commission, *A Draft Outline–Fourth Five Year Plan* (New Delhi, 1966).

Government of India, Planning Commission, *Fourth Five Year Plan,* 1969-74 (New Delhi, 1969).

Government of India for Irrigation Commission, Ministry of Education and Youth Services, *Irrigation Atlas of India* (Calcutta, 1972).

Government of India, *Location of Temples* (1964) Map.

Government of India, *Temples of North India* (New Delhi: Publications Division, 1968).

Government of India, *India Languages* (New Delhi: Publications Divisions, Ministry of Information and Broadcasting, 1970).

Government of India, *Report of the Official Language Commission* (New Delhi: Government of India Press, 1956).

Government of India, *India: A Reference Annual 1954-73* (New Delhi: Ministry of Information and Broadcasting, 1954-73).

India Meteorological Department, *Forecasting Manual,* Part I. *Climatology of India and Neighborhood.* No. 2. Climate of India (Poona-5 The Deputy Director General of Observations, 1968).

Joint Committee for Diagnostic Survey of Damodar Valley Region, The *Planning Atlas of the Damodar Valley Region* (Calcutta Unit, Technical Advisory Committee, 1969).

Karan, P.P., "Indian Industrial Change," *Journal of the Association of American Geographers,* Vol. 54, No. 3 (1964), p. 338.

Krishnan, M.S., *Geology of India and Burma* (Madras: Madras Law Journal Office, 1949).

Lamb, B.P., *India: A World in Transition,* 3rd ed. (New York: Praeger Publishers, 1972).

Majumdar, R.C.; Raychaudhuri, H.C.; and Datta, Kalikinkar, *An Advanced History of India,* 2nd ed. (London: Macmillan and Co., 1958).

Mookherjee, Debnath, and Morrill, Richard C., *Urbanization in a Developing Economy: Indian Perspectives and Patterns* (London: Sage Publications, Inc., 1973).

Rame Gawada, K.S., *Urban and Regional Planning: Principle and Case Studies* (Mysore: The University of Mysore, 1972).

*Report on the Development Plan for Greater Bombay,* 1964 (Bombay: Government Central Press, 1964).

*Rural House Types of South Asia,* South Asia Historical Atlas Project, Department of Geography, University of Minnesota. (A Map)

Sircar, D.C., *Studies in the Geography of Ancient and Medieval India* (Calcutta: K.P. Bagchi and Co., 1971).

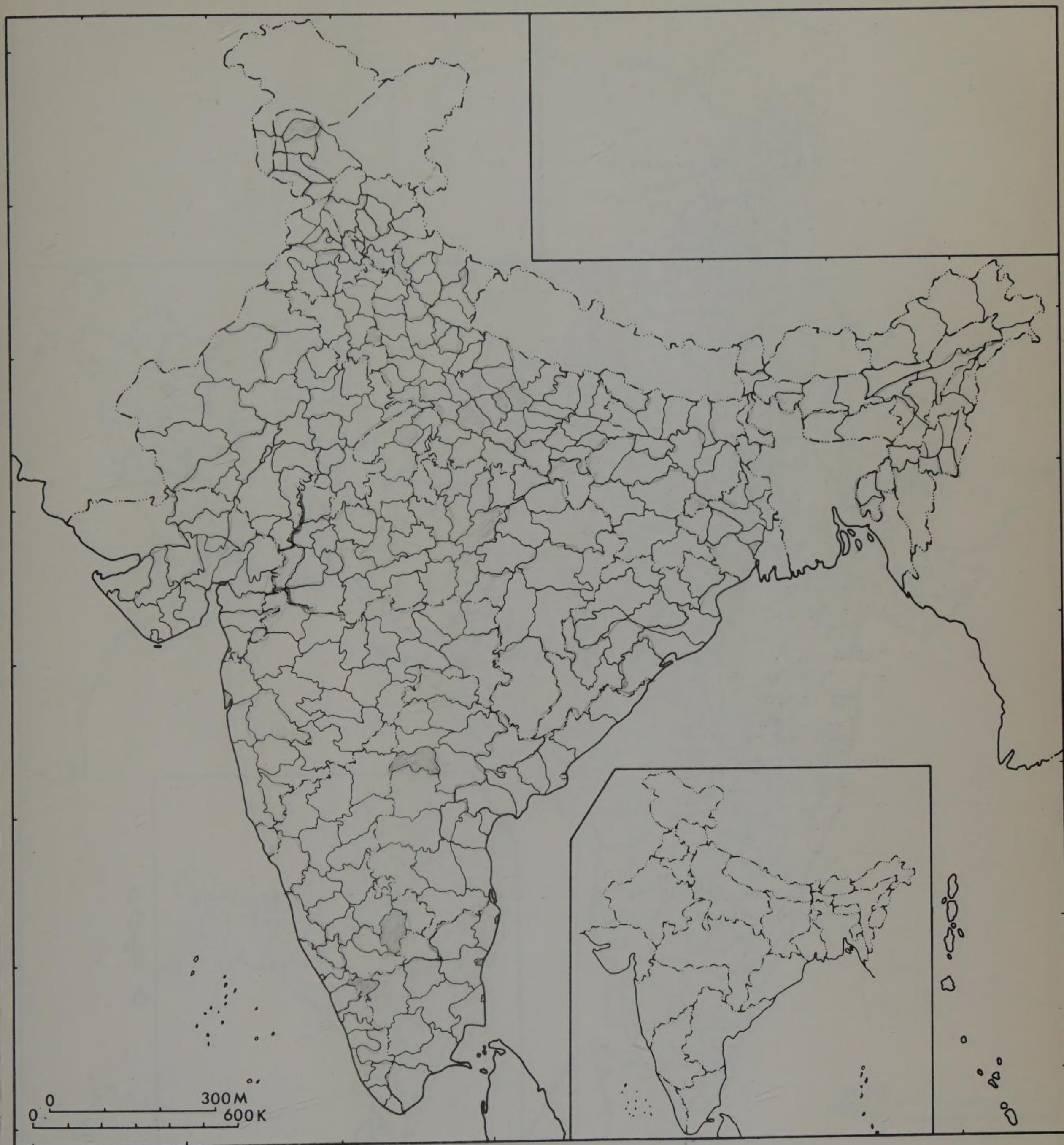
*South-Asia Administrative Divisions,* Syracuse outline series prepared by Syracuse University, Syracuse, 1967. (A Map)

Spate, O.H.K., and Learmohth, A.T.A., *India and Pakistan: A General and Regional Geography,* 3rd ed. (London: Methuen and Co., Ltd., 1967).

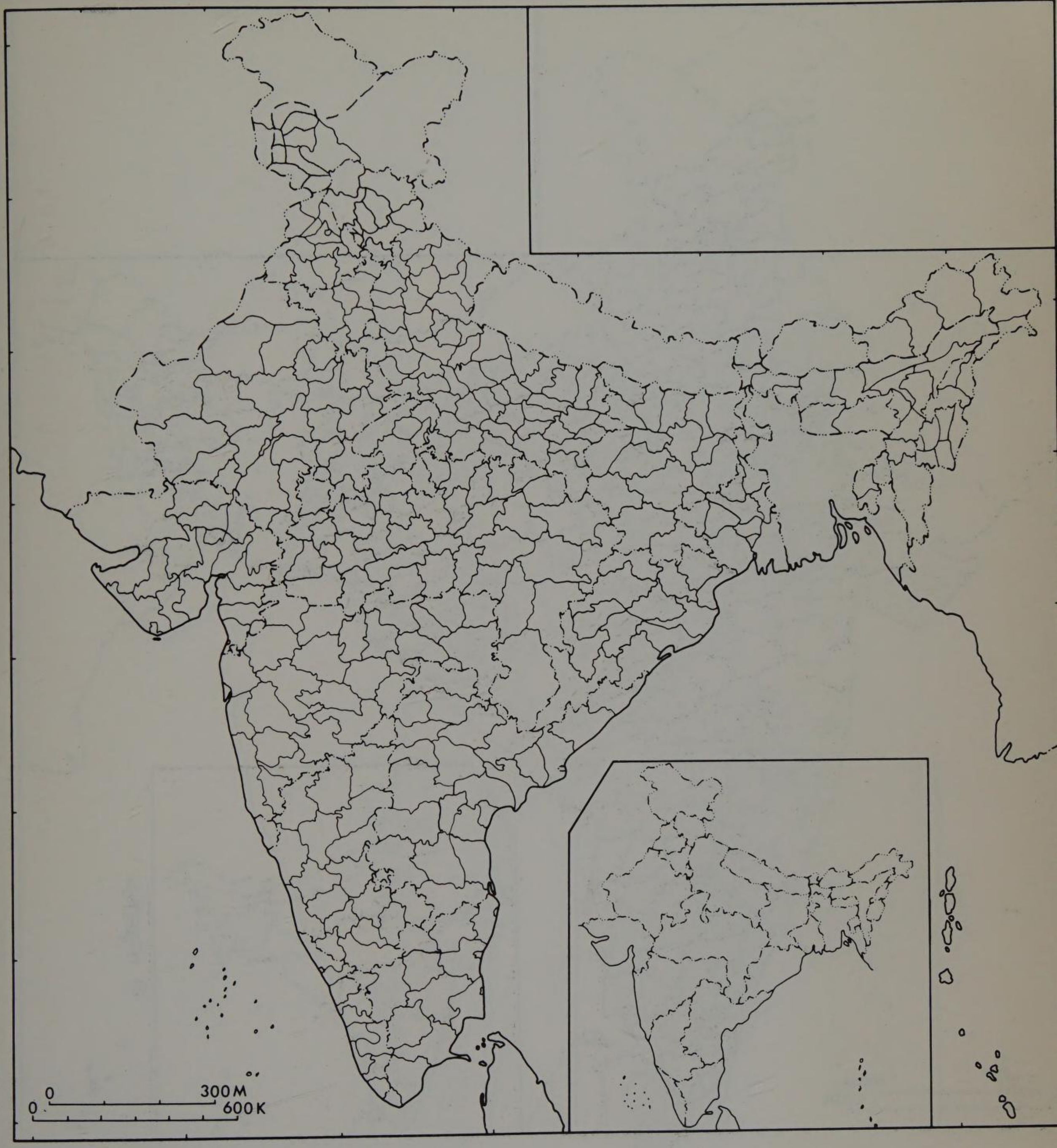
Stamp, L.D., *Asia* (London: Methuen and Co., Ltd., 1967).
Sukhwal, B.L., *India: A Political Geography* (New Delhi: Allied Publishers Pvt., Ltd., 1971).
*The Times of India, Directory and Yearbooks,* 1967-75 (Bombay: Times of India Press).
Tirtha, Ranjit, "Population Problems in India: A Battle with Hydra," *Focus,* Vol. XXIV, No. 9 (May, 1974).
U.S. Government Printing Office, *U.S. Army Handbook for India* (Washington, D.C., 1964).
Wadia, D.N., *Geology of India,* 3rd ed. (London: Macmillan and Co., 1953).
Yadav, R.K., *The Indian Language Problem: A Comparative Study* (Delhi: National Publishing House, 1966).
Yojana, Vol. XV Nos. 23, 24; Vol. XVI Nos. 1-3, 5-11, 13-22, 25, 26; Vol. XVII Nos. 1-4, 6-8, 10-12, 15-19, 21; Vol. XVIII Nos. 3, 5-10, 13-16, 18-20, 23, 24; Vol. XIX No. 7.

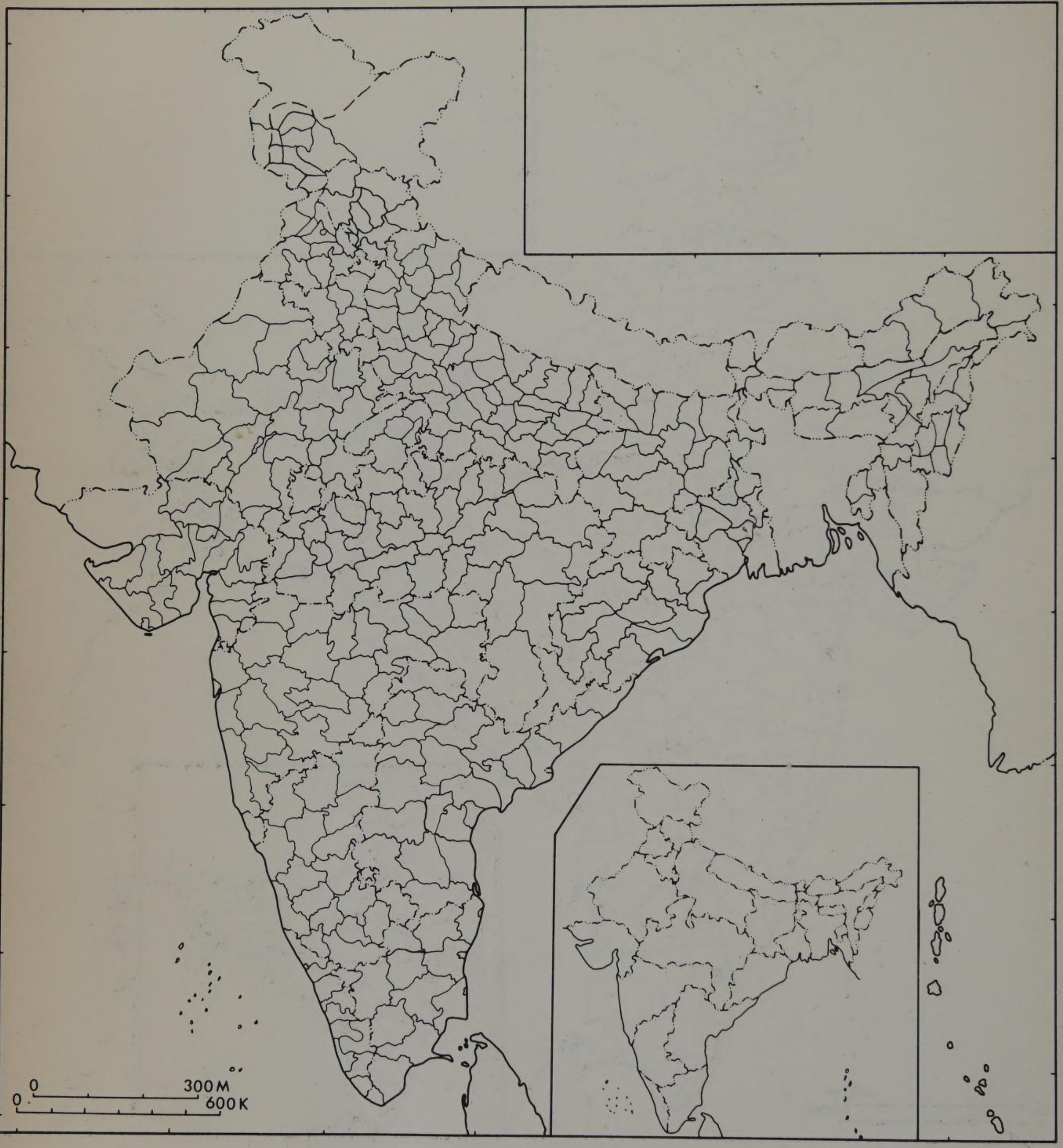
## ADDITIONAL REFERENCES

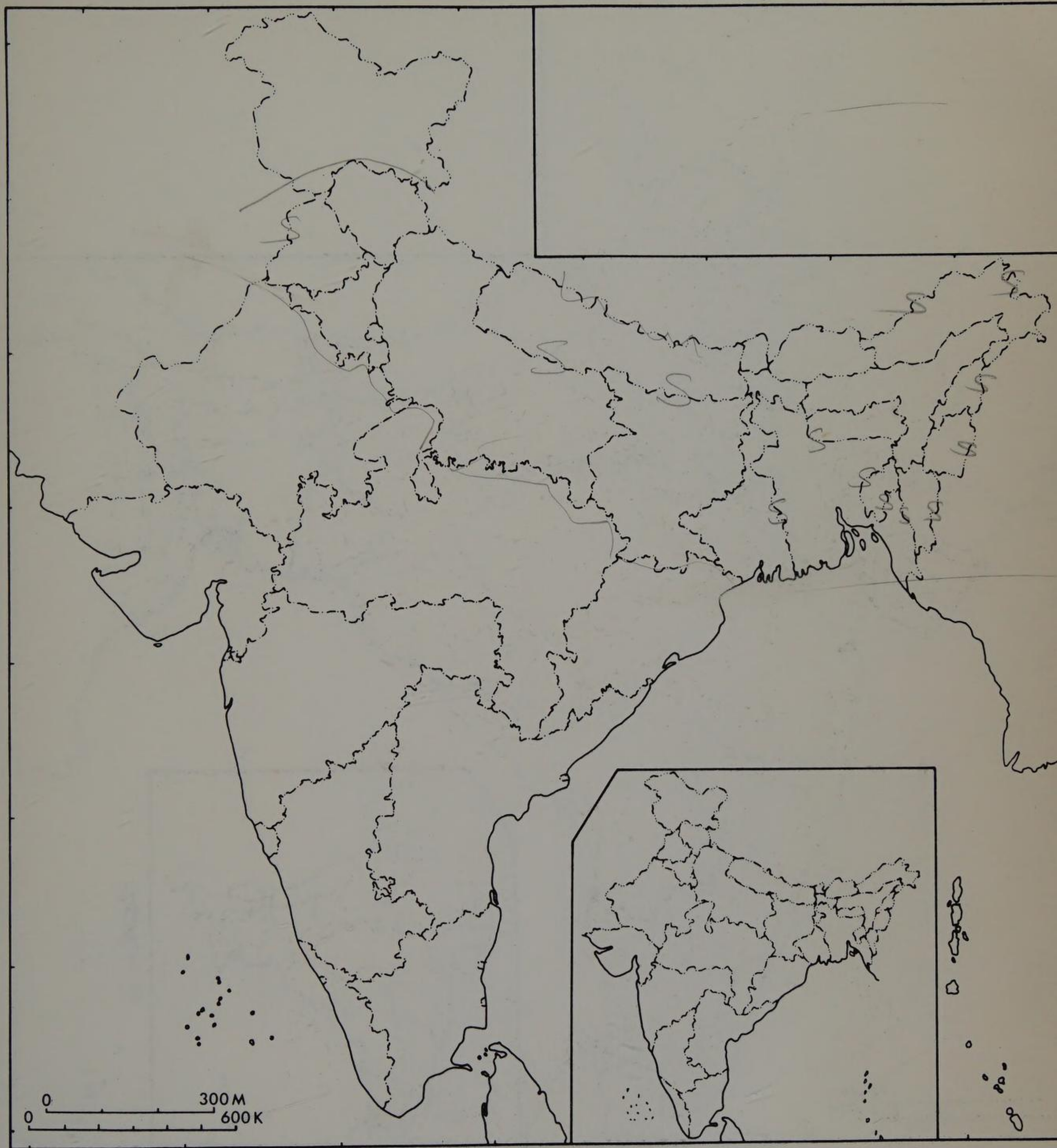
Bhardwaj, S.M., *Hindu Places of Pilgrimage in India: A Study in Cultural Geography* (Berkeley: University of California Press, 1973).
Bose, Ashish, ed., *Pattern of Population Change in India,* 1951-1961 (Bombay: Allied Publishers Pvt., Ltd., 1967).
——. "Six Decades of Urbanization in India," *Indian Economic and Social History Review,* 2, No. 1 (Jan. 1967), pp. 23-41.
Chakravarti, A.K., "India's Land Reform," *Focus,* Vol. XXIII, No. 9 (May 1973).
Johnson, B.L.C., *South Asia: Selective Studies of the Essential Geography of India, Pakistan and Ceylon* (London: Heinemann Educational Books Ltd., 1969).
Jakobson, Leo, and Prakash, Ved, "Urbanization and Regional Planning in India," *Urban Affairs Quarterly,* Vol. II, No. 3 (March, 1967).
Kashkari, Chaman, *Energy: Resources, Demand and Conservation With Special Reference to India* (New Delhi: Tata McGraw-Hill Publishing Co., Ltd., 1975).
Kingsbury, R.C., *South-Asia in Maps* (Chicago: Denoyer-Geppert Co., 1974).
Lal, Amrit, and Tirtha, Ranjit, "India's Urbanization," *Focus,* 19, No. 1 (Sept. 1968), pp. 1-7.
Prakasa Rao, V.L.S., *Regional Planning* (New York: Asia Publishing House, 1963).
——. "Land Use Survey in India–It's Scopes and Some Problems," *The Oriental Geographer,* 1, No. 2 (July, 1957), pp. 127-143.
Singh, R.L., ed., *India: A Regional Geography* (Varanasi: National Geographical Society of India, 1971).
Singh, R.P., *Geomorphological Evolution of Chotanagpur Highlands–India* (Varanasi: National Geographical Society of India, 1969).
Sopher, David, "Pilgrim Circulation in Gujarat," *The Geographical Review,* 58, No. 3 (July, 1968), pp. 392-425.
Spear, Percival, *A History of India,* Vol. 2 (Middlesex: Penguin Books Ltd., 1975).
Sukhwal, B.L., *South Asia: A Systematic Geographic Bibliography* (Metuchen, N.J.: The Scarecrow Press, Inc., 1974). This book provides an extensive bibliography on India relating to many topics covered in *India in Maps.*

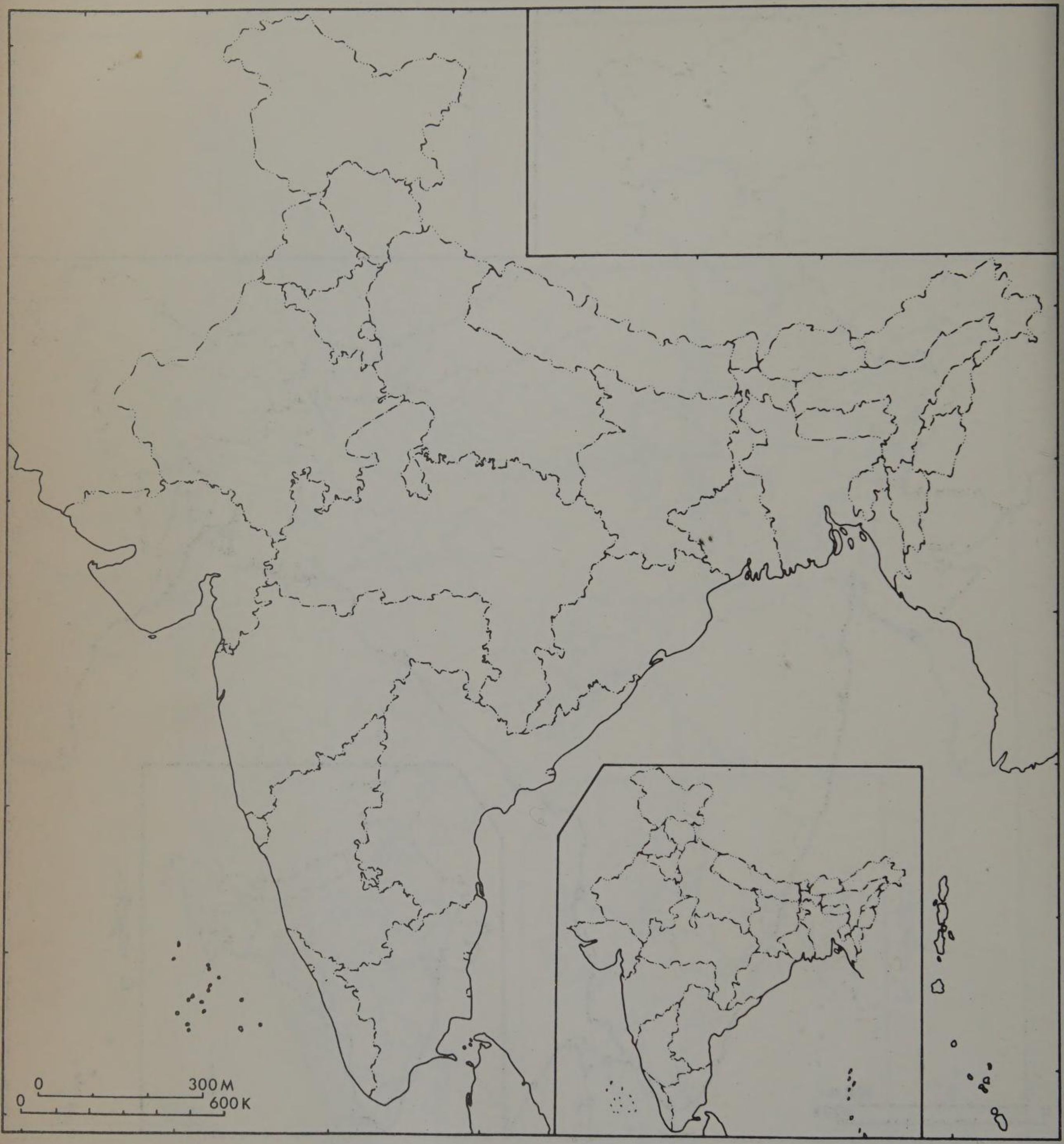

0
300 M
0
600 K

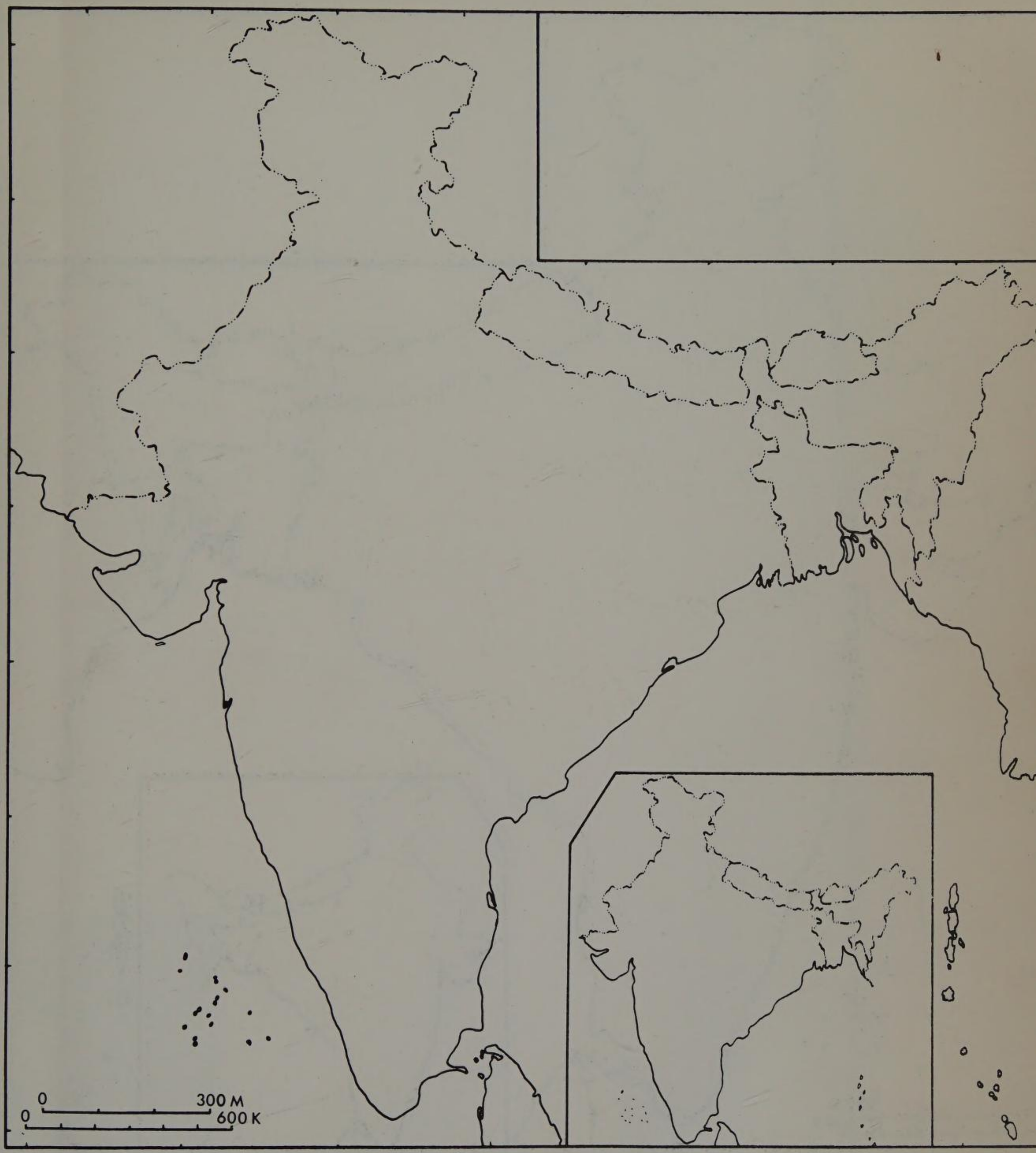
0 300 M
0 600 K

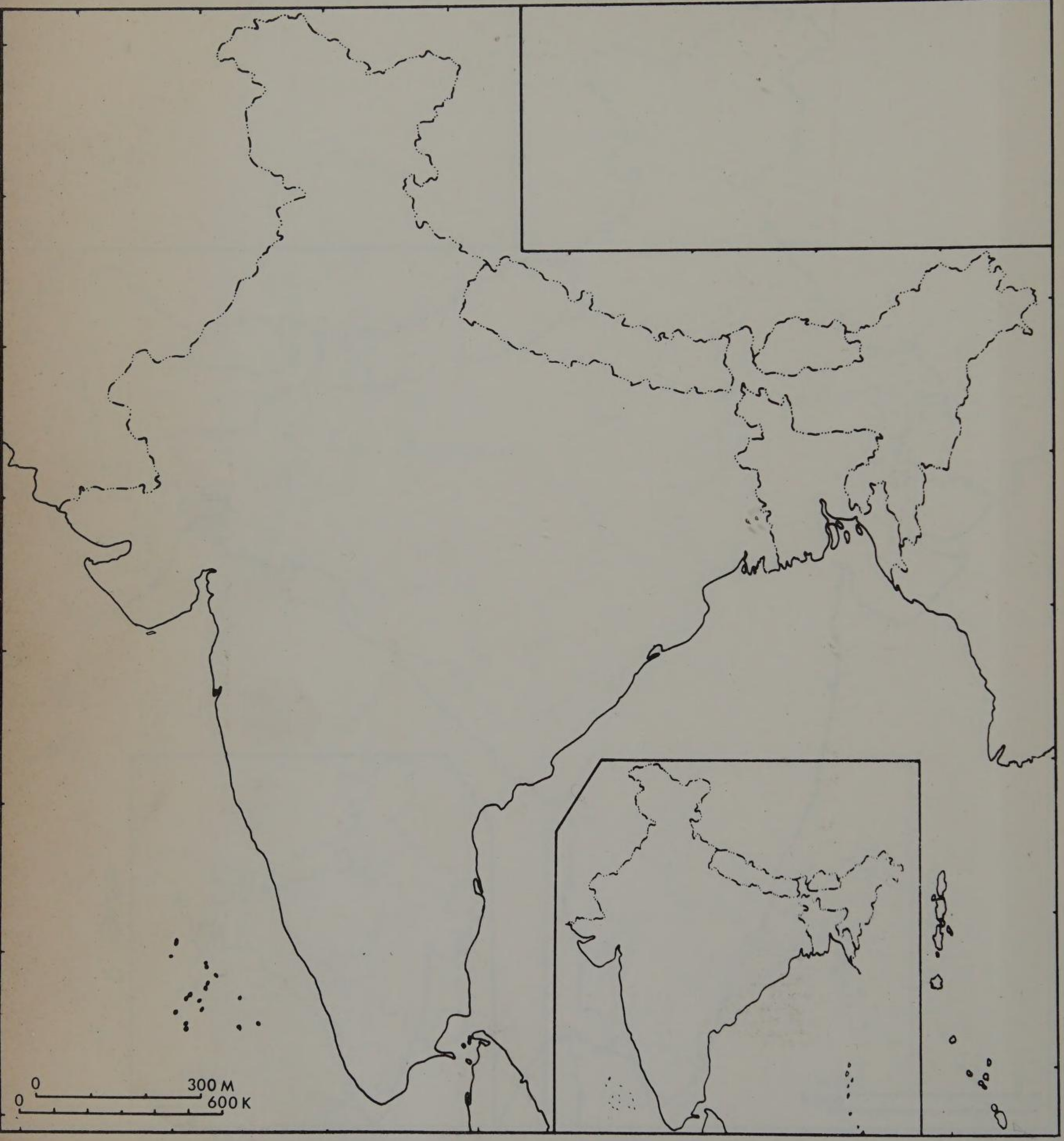

0
300 M
0
600 K


0
300 M
0
600 K


0
300 M
0
600 K


0
300 M
0
600 K


0
300 M
0
600 K


0
300 M
0
600 K

KL-672-981